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"Without Yielding Principles"

IN LAST WEEK'S issue the Engineering Record published part of Dean Marston's address on the qualifications of the engineer. In abstracting the paper it was necessary to omit a paragraph containing an epigrammatic expression that the young men coming out of college—and all young men—may well grave deeply on their memories. Speaking of the fundamentals of successful manhood, Dean Marston emphasized the importance of the "ability to make friends without yielding principles." *The ability to make friends without yielding principles* —what an epitome of the philosophy of true success! But the clause really expresses far more by indirection than the words themselves signify. What trials of moral strength, what pictures of careers hanging on a single decision does it bring us! The thought might well furnish food for much reflection. Suffice it, however, to point out that the friends, or supposed friends, who are lost by adherence to one's principles are not those whose loss should be bemoaned. The friendships that are really worth while are not jeopardized by staunch adherence to the truth. That should not deter one, however, from trying to cultivate those qualities which will enable one to continue friendships, to expand one's circle and at the same time cling fast to those principles without which there is no true success.

Water Analysis Not Black Magic

ONE of the big problems of the state health department, as cited by L. H. Van Buskirk at last week's convention of the American Waterworks Association, is to convince the public that the water analyst cannot be expected to pass judgment upon samples by means of black magic. He needs more than a pill bottle full of water to reach reliable conclusions as to whether or not the supply is fit for domestic consumption. The sample is of little value for analytical purposes unless it is accompanied by a specific explanation as to the conditions under which it was obtained, and, if possible, general information regarding sanitary conditions on the watershed. In fact, there developed at the meeting of the association's chemical and bacteriological section a strong tendency to attach more significance to the results of a sanitary survey than to the analysis of water samples indiscriminately collected. As John W. Alvord pointed out, the public has grown to expect from engineers answers correct to several decimal places, even though the data upon which such results are based are incomplete. This impression has been allowed to exist long enough. If an engineer is properly to exercise his judicial functions he must have all of the evidence at hand. Obviously this consideration applies to other fields of engineering than those which demand the service of the sanitary expert.

A. S. M. E. Power Test Code

CODES of practice are subject to limitations when their universal application is attempted, but it is difficult even for the trained worker in the field of power production to find anything fundamental lacking in the "Rules for Conducting Performance Tests of Power Plant Apparatus," recently published by the American Society of Mechanical Engineers. These rules represent a vast amount of unselfish labor on the part of the society's committee, and of the engineers, both inside and outside the organization, who discussed the preliminary report. Occupying a volume of 215 pages, the rules are nevertheless put forth in a form easily carried, compact in arrangement, with excellent cross-references and a completeness of detail which challenges admiration. It is not too much to say that the committee and its advisers have produced a classic handbook of practice in the field of prime-mover testing. The committee has done well to edit the code in such a way that its various sections can be utilized in the minimum time. A virtual standard of test procedure has been adopted, following these lines of thought: Object and preparations, apparatus and instruments, operating conditions, duration of tests, starting, stopping and records. In its wealth of detailed information about accepted units and standards of operation; its complete sample log-sheet forms; its examples of how various intricate problems associated with plant investigation are calculated from observed data; its treatment of tests of separate items of equipment, from gas producers to waterwheels, the code affords a valuable addition to the analytical resources of power engineers.

Engineering and the Dollar

IN the efficient operation of waterworks pumping plants attention is generally focused upon the engineering problems—the purchase of coal upon a heat-unit basis, the covering of steam lines to prevent loss by radiation, water evaporation per pound of coal, etc. In fact, these fields are so rich in opportunity for profitable study that the engineer is apt to forget that the pumping station involves a human, as well as a mechanical, problem. Some sound advice on this subject was given at the recent convention of the American Waterworks Association by Captain H. G. H. Tarr in his discussion of J. N. Chester's paper dealing with test duty and operating results. "Hitch up engineering with the dollar" has been the slogan which Captain Tarr has preached to all of the young men who have served on his staff. Applying this principle to the small waterworks pumping station, Captain Tarr made a plea for giving to the firemen some incentive for better work. He advocated, in effect, that a bonus be paid, based upon a specified scale of coal consumption. Such practice has a precedent in the operation of transatlantic liners, where the conservation of coal obviously is a factor of far greater importance than it is on land. Here the bonus system has worked with excellent results, for it takes into consideration the human problem and rewards a man in proportion to the care and intelligence he exercises in the operation of his boilers. It is safe to assume that none of the remarkable tunneling records would have been accomplished without the bonus system. There is food for thought in the application of the bonus system to pumping-plant operation. Certainly the scheme has demonstrated its value in other fields. There is no apparent reason why its success would not be equally well assured if its use became more general at waterworks pumping plants.

Are Better Contracts Coming?

IN a widely discussed paper read in March before the Engineers' Society of Western Pennsylvania J. W. Rollins called attention to the evils of present practice in contract writing for which Engineering Record proposed a remedy in an editorial in the issue of May 27. His paper, which ably presented the losses occasioned by these shortcomings, with favorable and pointed discussions by J. A. L. Waddell, C. L. McKenzie, Samuel E. Duff, G. W. Snyder and other men of authority, has recently been issued in the March *Proceedings* of the society. This statement not only proves that reform is needed, if further proof were required, but brings out the point that the wasteful clauses attacked do not even deserve the defense that they enable the engineer to control dishonest contractors. This defense is not justifiable on any consideration. If an engineer is not convinced that a contractor means to do the work to the best of his ability, he has no more right to countenance an award to that contractor than has a government quartermaster officer to place an order for food with a concern that is known to deal in spoiled provisions. In every line of business the crooked firms have been eliminated by the refusal of honest people to deal with them. No other method, it is safe to say, has ever met with conspicuous success. If honest engineers will continue to permit owners to deal with dishonest contractors, no quantity of stringent verbiage in the contract documents will ever eliminate the latter from the field. As long as the man of questionable methods gets work, he will continue to "get away with it."

At present it is not possible for many engineers to take this stand. As has been pointed out by this journal, a large amount of educational work must be done by engineers before owners—especially public officials—can be expected to see the subject in its true proportions. What is needed is for the engineering organizations, especially the American Society of Civil Engineers, to take a decisive stand, and back up the individual engineer with all their influence. The best way to do this is to have the whole matter of contract documents thoroughly studied by a competent committee, and standards recommended which will command respect from owners, lawyers and engineers alike.

Why do not the men who have so ably discussed this subject before the society referred to, and other engineers who have shown a lively interest in this question, get together and urge action? If they will, it is safe to say that their efforts will be attended with immediate and practical results such as will never be accomplished merely by further discussion.

Double Test for Engineers

CLAIMING that the method of classification adopted by Professor Mann, in stating the results of his investigation of engineering education, leads to absurd conclusions in testing the fitness of candidates for engineering work, Dean Anson Marston advocates the use of a double, instead of a single, standard of comparison. He shows convincingly the necessity for two tests—one of engineering skill and the other of general manhood qualities—in each of which 100 per cent represents perfection. In his address to the alumni of Iowa State College, abstracted on page 764 of last week's issue, Dean Marston proposed certain subdivisions for estimating the qualifications separately. Such qualifications can be determined by the teachers. The information should not only lead to a proper estimate for recommendation to prospective employers, but should stimulate the whole teaching staff to more intelligent handling of the students.

Dean Marston also suggests three improvements in engineering education which are worthy of earnest consideration. His plea for experienced teachers, engaged on the basis of business hours and business standards, is directly in line with what Engineering Record has already advocated. The third suggestion, which requires practical engineering work by the students between the sophomore and the junior years, would immeasurably improve the quality of the last two years of college work. Experienced teachers agree that the most earnest and productive of their students are those who have had outside experience or are working their way through college.

One other idea suggested by Dean Marston should be strongly emphasized. To-day, when overspecialization in engineering courses is being criticised and deplored, it is well to remember that technical subjects properly taught may be made broadly cultural through the personality and breadth of experience of the teacher. This is not done, however, by recounting the details of big projects with which the professor has been connected, but through thoroughness of understanding and a comprehensive view of the relations of the engineer's particular problems to human problems and activities. Furthermore, highly specialized subjects, in addition to thorough theoretical training, should be taught by the use of practical problems solved by the best methods developed in engineering offices. Broadening of engineering curricula must not mean less exact training in technical details, but less time devoted to following special lines to extreme limits. Thesis work and graduate work offer the necessary outlets for advanced specialization, which should not be made a general requirement for all undergraduates.

The postponement of specialized details will make room in the curriculum for the general courses so much desired. To be effective, however, the courses giving a broadening outlook must be made to appeal strongly to the students by showing them the relation of these general subjects to the life and work of the engineer.

Following Cincinnati's Lead

DOUBT, and in some quarters a quiet scorn, greeted the announcement not so many years ago of the establishment at the University of Cincinnati of the co-operative courses in engineering. The fundamental principle underlying the new system—that engineering education should be planned with reference to the requirements of practice—was not disputed. In fact it was, or should have been, recognized that Dean Schneider's plan was a revival of the apprenticeship system, supplemented by the broadening influence of a theoretical training far more thorough than was possible under the old system. Despite the sound historical and theoretical bases, however, it was not believed that the plan would prove successful. The co-ordination of the classroom work with that of the shop and the enlistment of the aid of industries seemed to offer insurmountable obstacles. They would have been insuperable, too, had the execution of the plan been intrusted to anyone less determined than its author, and with less faith in its soundness and in the ultimate results.

Results count, and to-day the co-operative system at Cincinnati stands not only as a success, but as a pattern of similar curricula and the inspiration of related plans elsewhere. The co-operative system at the University of Akron is a direct offshoot of the Cincinnati work, while the courses at Marquette University and Detroit College, comparatively new engineering schools, were patterned after the Schneider plan. Probably, too, the directors of the co-operative course in mechanical engineering at Lafayette College drew their inspiration from the Ohio school. At least one technical high school is fashioned on the same lines.

But these are not the only evidences of the influence of the Cincinnati idea. These have followed the plan in its fulness; others have gone part way. In some quarters, co-operative measures and industrial school co-ordination have not been adopted, but their indorsement by prominent educators indicates no less than positive action how wide the influence has been. For instance, in the controversy between Professors Mead and Swain, the latter said (see Engineering Record, May 6, 1916, page 609): "I am inclined to look upon the work which is being done by Dean Schneider at the University of Cincinnati as one of the most promising developments in modern technical education." Again, Dean Marston, in the address abstracted on page 764 of the Engineering Record of June 10, proposed that present curricula be modified by requiring one year or more of actual engineering work outside the college, immediately following the sophomore year.

Practical applications of related ideas are found in the schemes just announced for the school of chemical-engineering practice at the Massachusetts Institute of Technology. The Yale plan has been worked out in co-operation with the alumni; the engineering courses at Sheffield are five years in length, two years of undergraduate work being completed after the award of the first degree. The corporations co-operating select, with the aid of the faculty, a student who has received his first degree and whose fitness and liking for the business in question have been made the subject of careful inquiry. The student is employed at a nominal figure. After becoming familiar in a general way with his employer's business, the student is given some engineering problem, varying from the perfection of a machine or process to some question of management. Half his time is devoted to this problem, the solution of which constitutes his thesis. The summer between his fourth and fifth years is spent in the works of the corporation. At the completion of his course it is the expectation that he will enter permanently the business of the corporation which has helped to educate him. The advantages on either side are obvious.

The plan announced by the Massachusetts Institute of Technology is declared, in the institute circular, to be "the greatest forward step in technical education since William Barton Rogers established the institute, and it is an extension of the practice of Rogers, whose ideal was 'to teach young men by making them do things.'" The plan outlines a five-year course in chemical engineering, leading to a master's degree. The first three and a half years are spent at the institute, obtaining a knowledge of the fundamentals of chemistry and engineering, the next nine months in five or six industrial plants, and the last nine again at the institute. The main feature of the plan is the emphasis on the nine months spent in direct contact with industry. The institute will maintain a professor and a well-equipped laboratory in each of the five or six stations. The students will be divided into as many groups as there are stations and will pass around the circle, spending about six weeks in each plant. The stations have been selected not merely because of the importance of the industries with which they are connected, but because those particular plants well illustrate certain fundamental processes which the chemical engineer must thoroughly understand.

Needless to say, the Engineering Record's hearty indorsement of the Cincinnati plan must extend, though in a modified degree, to the Sheffield and Massachusetts Institute schemes. The last two are still to be worked out. As planned, they impress one favorably. Whether the results will be as good as those obtained at Cincinnati remains to be seen. They have the disadvantage of bringing the student into contact with industry rather late in his course, when it is difficult to correct the erroneous trends that may have been caused by the first three or four years of his theoretical training. At Cincinnati, from the start, the student is tested against the conditions which will surround him throughout his professional career. Tendencies in a wrong direction are nipped in the bud and cannot become confirmed mental attitudes or habits.

Certainly, the movements here noted are very strong indorsements of the co-operative idea carried out in its fulness at Cincinnati. While some of those concerned with the formulation of the later plans may not be willing to confess their indebtedness to the Cincinnati example, from the standpoint of the outsider, viewing educational movements at a distance, the Cincinnati influence seems very apparent.

Awakening of the American Waterworks Association

At its thirty-sixth annual convention, held in New York City last week, the American Waterworks Association showed signs of awakening to a realization of broader opportunities for service. With its membership increased to more than 1300, prospects bright for the acquisition of several new local sections and finances in a sound condition, the organization possesses latent power which, neglected in the past, is now ready to be developed along intensive lines. In his presidential address, an abstract of which was published in last week's issue, page 766, the retiring chief executive, Nicholas S. Hill, Jr., offered a number of constructive recommendations pertaining to the general administration of the society's affairs. With a man of the caliber of the new president, Leonard Metcalf, in office, it is safe to predict that the coming year will mark a new era of progress in the association's history.

It is time now for the association to realize that its administrative machinery, which may have been adequate for a membership of a few hundred a decade ago, has become obsolete when applied to a roster of the present size. One of the most important changes advocated by Mr. Hill is the separation of the duties of the secretary and editor. The demands upon the secretary's time have increased enormously since the movement for local sections throughout the country gained impetus, and any secretary, with his own private interests to attend to, will have his hands more than full in transacting the society's routine business and co-ordinating the work of the local sections with that of the parent body. Just as soon as the finances of the organization permit, the office of editor should be established.

The American Waterworks Association is not, primarily, a social organization, although the opportunity for personal contact at its conventions and section meetings is highly important. Its usefulness must be gaged, in large measure, by the kind of technical information it supplies to its members, either in printed form or at its conventions in the shape of papers or reports on technical subjects. Of course, there are other possibilities of service for the association, as Mr. Hill suggests, but no better beginning could be made than in the improvement of the printed proceedings and the arrangement of the convention program.

In this work the Engineering Record sees a much broader field of usefulness than is indicated by Mr. Hill's remarks. The editor's duties must not be confined merely to the preparation of copy and the reading of proofs. They must go even beyond the effort to determine what subjects are of most timely interest and who are the best men to discuss them. Granting that these matters are essential, the duties of the editor should include the effective use of papers and committee reports after they have once been secured. The association needs a man who can show its wares to the outside world as well as to the members themselves, for often the vital feature of a paper or report is so buried in a mass of inconsequential detail that it is passed by without having its full significance brought out.

If a salaried editor is to be appointed, let him be not merely a good engineer, but also a good journalist—a man with a quick appreciation of news value. Let this man, who can "see the story," have the leading part in the arrangement of the convention program. On such occasions he should be a sort of stage manager, who will sense the really important features of the convention, give them the choice places on the program and insist that they be presented according to schedule. In this way only will their full effect be realized and the association receive the maximum benefit therefrom. On this score of publicity for its activities the association has shown a pitiful ignorance—an ignorance which, if allowed to continue, will be a serious check upon the growth of the association in the esteem of its own members and of the outside world.

Now to get down to specific cases: Last week's convention offers a conspicuous example of lost opportunity. Without any doubt the big feature of the five-day session was George A. Johnson's paper "The Typhoid Toll." Not since Allen Hazen, years ago, propounded his theorem dealing with the reduction of the death rate by pure water has the case for filtration been put so forcefully. Full publicity for Mr. Johnson's paper among the members, and particularly in the daily press of the country, would have been one of the greatest educational achievements which the American Waterworks Association could have sponsored. What is more, the dissemination of the facts which Mr. Johnson enunciated would have meant money in the pockets of waterworks men. Before a city can build a filtration plant it must have the support of public opinion. Any steps that can be taken to foster public sentiment in favor of pure water should not be neglected. With the people realizing that typhoid fever is a water-borne disease and is preventable, it will not be long before there is a general demand for filters. The result, of course, will be more work for the waterworks engineer.

What happened at the convention last week? The ammunition, in the form of Mr. Johnson's paper on typhoid prevention by water filtration, was fired blindly, so far as its full effect on the members of the association and the general public is concerned. The paper was scheduled for presentation Wednesday evening, following the vote on the selection of a city for the next convention. With the convention hall packed, speaker after speaker was permitted to dilate upon the claims of his home town as the next convention city. A limit of five minutes had been set for each of these speakers and was promptly disregarded. At last a vote was taken, and when the ballots were counted the whole farce had to be repeated, as there was no majority on the first count. When this buffoonery was concluded it was too late for the feature paper of the convention. It found no place on the program next day, but Mr. Johnson had the satisfaction of being called upon at the very close of the final session at noon Friday, when everyone was ready for a recess. At this late hour there was no time for the written discussions, in spite of the fact that communications had been received from such national figures as Dr. Harvey W. Wiley and Surgeon-General Rupert Blue.

A great opportunity for educational work was wasted, and the whole affair was particularly lamentable, because, if the paper had been given a place of prominence on the program, it would undoubtedly have been reported by such influential metropolitan dailies as the New York *Times*, which gave about half a column to each of the first two days' sessions and then, apparently, decided that the important papers had been delivered and that the remaining sessions would be given over to discussions of no interest to the lay reader. As the paper on typhoid and filtered water was being discussed there were perhaps from 50 to 75 men in attendance, whereas, if it had been properly scheduled, it would have had an audience of several hundred, to say nothing of the value of the publicity in the daily press.

This instance demonstrates the need, in the arrangement of convention programs, of a man with perspective, who can sense the big things and give them the display their importance warrants. If the association secures a man of the proper caliber to handle such matters it will not be long before it will make its influence felt beyond the confines of its convention halls.

Regulation of Weight, Size and Speed of Vehicles Has Become an All-Important Problem

Development of Motor Truck to Extra Widths and Very Heavy Wheel Loads Calls for Legislation to Make It Pay Its Fair Share of Added Costs of Street Construction and Maintenance

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DURING the past ten years the advent of the motor truck has introduced new problems to those in charge of street and highway management. There have been large and special types of horse-drawn vehicles in existence for many years, such as trucks for hauling steel girders and columns, printing presses, boilers and other heavy materials through the streets. Steam traction engines have also existed for many years, and are occasionally to be met with on country highways. These heavy vehicles, however, are not very numerous and their affect upon the pavements is not very great, owing to the slow speed at which they are driven and the care taken by their owners and drivers not to cause unnecessary damage.

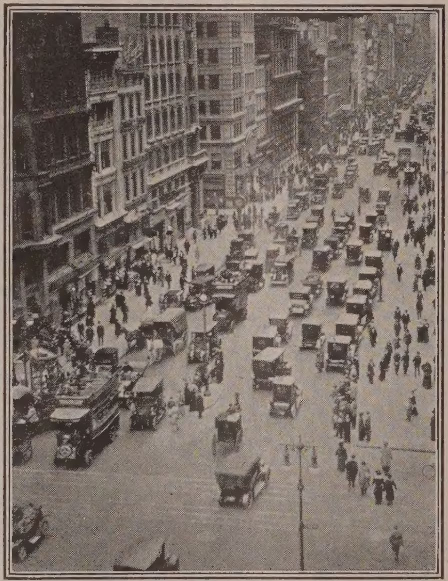
The advent of the motor truck has introduced new features into the problem, however, as there has been a marked tendency on the part of the manufacturers of these vehicles to increase their loading capacity and speed. It is self-evident that the cost of hauling can be greatly reduced if the size of the vehicle is increased, since the cost per ton hauled for fuel, wages and other items is reduced. The proposition from the standpoint of the manufacturer and the owner of motor trucks is of course to get the greatest return in hauling capacity for the investment and cost of operation and maintenance.

WEAR AND TEAR ON PAVEMENTS

The cost to a city, town, state or county for increased wear and tear on pavements should also enter into the problem. It is easy to say, for instance, that a city should lay pavements strong enough to withstand the shock and wear and tear caused by the heaviest type of truck, or that a state or county should have roads that will stand the wear and tear due to the passage of heavy automobiles or trucks at a high rate of speed. The immediate replacement, however, of all the pavements in a city is no small matter.

The borough of Manhattan, comprising the central part of New York City, has approximately 450 mi. of pavements. If we assume that they have an average width of 30 ft. of roadway that would have to be paved by the city, the total area would be 7,920,000 sq. yd. If all these streets had to be resurfaced with a better type of pavement costing $2.50 per sq. yd., the total cost to the borough of Manhattan alone would be $18,800,000. If it were found necessary to add 1 in. extra thickness of concrete to the pavement foundation as a provision to take care of the heavier traffic, there would be 220,000 cu. yd. of concrete required, which at $5 a cu. yd. would cost $1,100,000. This extra cost would have to be borne by the taxpayers. Among these are the owners of the vehicles themselves, but they would pay only an infinitesimal part of the extra costs of paving and maintenance of old paving, while the majority would derive no benefit at all.

While it may not be advisable to reduce vehicle sizes now in existence, certain principles of design of these vehicles could be followed which would reduce the wear and tear on pavements. One would be the limitation of the allowable load per inch of width of tire. A sliding scale of license fees could be made so that wheels above a certain loading, such as 750 lb. per in. width of tire, would be taxed at a gradually rising rate, with a consequent tendency on the part of owners and manufacturers to reduce the unit-width load to a minimum at which the lowest rate could be obtained, and thereby reduce the wear and tear on pavements by reducing the unit pressure on them. In an ordinance prepared for New York City in 1913 it was proposed to tax the loading per inch width of tire as per Table 1.



FIFTH AVENUE, NEW YORK, READILY CARRIES SIX LINES OF ORDINARY VEHICLES, BUT EXTRA-WIDE TRUCKS MIGHT CROWD OUT TWO OF THE SIX

TABLE 1—PROPOSED LICENSE SCHEDULE BASED ON LOAD PER INCH WIDTH OF TIRE

(a) Vehicles carrying or intending to carry a total gross load of 6000 lb. or less upon any wheel shall be charged the following annual license:

Loads in Pounds per Inch Width of Tire	License Fee for Each Vehicle
750 or less	$1
751-800	3
801-850	6
851-900	12
901-950	25
951-1000 (max.)	50

This would tend to prevent the operation of vehicles having narrow tires which are so heavily loaded as to cut into the macadam and asphalt pavements now laid on many city streets.

VERY HEAVY LOADS

Certain types of vehicles now in operation are too heavily loaded for any pavement to support. At the present time pavements in New York City are laid with a 6-in. foundation of concrete, which will support a very heavy load. But if it becomes necessary to lay pavements to provide for some of the excessive loads now seen in the streets, and to provide in addition for probable increases in such loads in the future, the cost of street construction will be greatly increased for the benefit of a few vehicle owners, causing a greatly increased tax upon the city at large. A pavement foundation is a thing that is not renewed every year. This burden would be more equitably borne by imposing a tax upon vehicles of excessive weight, and accordingly a schedule was prepared for additional fees upon the basis of Table 2.

EFFECT OF EXCESSIVE SIZES OF TRUCKS

In addition to the foregoing problems a further problem has been found in many large cities due to excessive traffic on certain streets. If all vehicles were of a uniform width and length, the problem of proper street widths and congestion of traffic might be easily solved. There has been a tendency, however, to construct vehicles of very great width and length, thereby producing greater carrying capacity, such as moving vans, coal wagons, trucks for hauling dirt and stone and the like. These vehicles occupy more space in the roadway than do the average vehicles, often destroying the balance of traffic by preventing the movement of two lines of vehicles on congested streets such as Fifth Avenue, where six lines of vehicles of ordinary width can be operated.

If a street has a capacity for two or more lines of vehicles of an average width of 6 ft. 9 in. in each direction, two large trucks occupying 8 or 9 ft. in width will block off one line of traffic in each direction and cause a 50 per cent reduction in the traffic capacity of that street. Many streets in New York City have been widened in the past few

TABLE 2—ADDITIONAL FEES FOR LOADS OF FROM 6000 TO 10,000 POUNDS PER WHEEL

(b) In addition to the fees provided for in subdivision (a), further fees shall be charged for loads greater than 6000 lb., but not exceeding 10,000 lb. upon any wheel as follows:

Weight in Pounds per Wheel	License Fee for Each Vehicle
6,001- 6,500	$75
6,501- 7,000	110
7,001- 7,500	150
7,501- 8,000	200
8,001- 8,500	300
8,501- 9,000	500
9,001- 9,500	750
9,501-10,000	1,000

For loads greater than 10,000 lb. per wheel, license fees shall be charged for each vehicle at the additional rate of $500 for each 1000 lb. increase in weight, or portion thereof, per wheel; provided, however, that no load greater than 1000 lb. per inch width of wheel shall in any case be permitted, except as specified in subdivision (d).

In lieu of the fees hereinabove provided for in subdivisions (a) and (b) for loads of 6000 lb. or more on any wheel, special permits may be issued for single trips and fees charged therefor at the rate of 10 per cent of the fees therein provided, except that no single fee shall be less than $25; and in lieu of the fees provided in subdivision (c) for excess width of vehicle, special permits for single trips may be granted upon payment of a single fee of not less than $10.

years at considerable expense both to the city for extra pavement, changes in sewer basins, etc., and to property owners for the removal of encroachments and the reconstruction of vault space necessary on account of widened roadways. If this widened space is to be monopolized by vehicles of unusual size, proper fees should be paid by the owners of the vehicles to offset the expense of the widening of streets.

The ordinance proposed in 1913 had charges for extra widths of vehicles as per Table 3.

In order to enforce the ordinance properly it provided for license plates, to be attached to each side of the vehicle, stating the weight of the empty vehicle, the maximum load capacity per inch width of tire and most heavily loaded wheel, and the width over all of the vehicle. These plates were to be furnished by the city upon payment of the license fees and were to be attached in a conspicuous place as directed by the chief of the Bureau of Licenses.

Weighing stations were to be established in various parts of the city at which all vehicles should be weighed whenever required by a duly authorized representative of the Bureau of Licenses.

If the ordinance were violated, the owner of the vehicle was liable to a revocation of his license and should be deemed guilty of a misdemeanor, and if convicted, could be fined not less than $100 nor more than $500, or not more than ten days in jail.

PACKING, SHIPPING, CRATING
PALACE FIREPROOF STORAGE AND WAREHOUSE CO.
826 SEVENTH AVE at 53RD ST. N.Y.

TWO TYPES OF EXTRA LARGE AND HEAVY MOTOR TRUCKS—CONTRACTOR'S OUTFIT ON RIGHT HAS CAPACITY OF 18,000 LB., TOTAL LENGTH OF 32 FT. 3 IN. AND WIDTH OF 8 FT. 7 IN.—REAR (STEEL) TIRES ARE 8½ IN. WIDE

The question of speed of traffic has long been a subject of regulation by all cities, but this has been due to the desire to protect lives and to prevent accidents rather than from any effect upon pavements. It is self-evident, however, that the same principles of impact that have to be taken care of in the design of bridges will apply in the design of pavements, and that the increased speed due to the advent of motor vehicles must give an increased load due to the impact of heavy wheels moving at higher rates of speed than with horse-drawn vehicles. Even the argument that motor vehicles have rubber tires does not fully offset this, as the tires and springs of the vehicle do not reduce very much the blows that the pavement receives. There is also a tendency on the part of large trucks to use steel-tired wheels to carry the greatest load, which give very heavy shocks to the pavement when moving at speeds of from 10 to 15 mi. per hour. The horse-drawn vehicles which these trucks supplant did not go more than 3 or 4 mi. an hour.

In New York City complaints have been received by the authorities from property owners of excessive vibration felt, and actually measured by recording instruments, due to the rapid movement of heavy motor buses and trucks through the street. In one case complaint was made that the excessive vibration had broken off the gaspipe connection in a private house past which there was a constant movement of heavy trucks carrying earth and rock for a subway contractor. The vibration of the house could be plainly felt even in a rear room on the second floor at the time an investigation was made. If the vibration is so plainly felt in houses, there certainly must be a very bad effect on pavements, as they bear all the direct blows from the heavy truck wheels.

The Highway Commission of the State of New York limits the maximum weight of vehicles on the highways to 14 tons, with a further limitation of 9 tons on any one axle. The load per inch width of tire is limited to 800 lb., and the total width of any vehicle is limited to 7 ft. 6 in., with the exception of traction engines, which may be 9 ft. 2 in. wide. The speed is limited to 15 mi. per hour for vehicles weighing from 4 to 6 tons, and 6 mi. per hour for vehicles with iron or steel tires, and to 12 mi. per hour with rubber tires or other similar substance. Special permission for vehicles weighing more than 14 tons must be obtained from the commission.

TABLE 3—PROPOSED CHARGES FOR EXTRA WIDTHS OF VEHICLES

(c) Vehicles 6 ft. 6 in. or more in width over all shall be charged, in addition to the fees specified in subdivisions (a) and (b), the following annual fees:

Width of Vehicles	License Fee for Each Inch in Width in Excess of 6 Ft. 6 In.
More than 6 ft. 6 in., but not to exceed 7 ft. 0 in.	$5
More than 7 ft. 0 in., but not to exceed 7 ft. 6 in.	10
More than 7 ft. 6 in., but not to exceed 8 ft. 0 in.	15
More than 8 ft. 0 in., but not to exceed 8 ft. 6 in.	20
More than 8 ft. 6 in., but not to exceed 9 ft. 6 in.	25

In determining this fee any width which is greater than 6 ft. 6 in. by a fraction of an inch, or by a distance which contains a fraction of an inch, shall be reckoned as if it were the next greater even inch.

(d) No loads, harness or other appurtenances shall in any case be allowed to extend beyond the outside limits of any vehicle except as specified in subdivision (c).

Chicago has an ordinance requiring that all motor trucks shall have rubber tires or some material of equal resiliency. The maximum load per inch width of tire is limited to 1000 lb. The maximum load and weight of the vehicle shall not exceed 15 tons and the maximum axle load shall not exceed 12 tons. The maximum width permitted is 8 ft. 6 in. and the maximum length 40 ft. The speed of motor trucks is limited to that of the Motor Vehicle Law of the State of Illinois and the rate of speed is limited to 4 mi. per hour when there is a defective tire which tends to cause additional injury to the pavement or additional noise. The operation of tractors and trailers not exceeding 100 ft. in length is permitted between 8 p. m. and 5 a. m. at a rate of speed not to exceed 8 mi. per hour upon routes designated in a permit. Special permits are necessary for transporting loads exceeding 12 tons per axle, and a bond of $10,000 is required to pay for any damage that may be caused to city structures.

Boston has street-traffic regulation which limits the width of vehicles to 10 ft. except by special permit from the Board of Street Commissioners. The extreme length of trucks and drays is limited to 24 ft. 6 in., and motor vehicles are limited to 26 ft. The maximum load that a vehicle may carry is limited to 6 tons except by special permit.

London limits the width of motor cars to 7 ft. 2 in. Special widths of tires are prescribed for motor cars of different weights, except when pneumatic or other elastic tires are used. The maximum axle weight allowed is 8 tons, and the total weight on all axles shall not exceed 12 tons.

LARGE AND SMALL WHEELS

The regulations also provide for the difference in effect upon the pavement of large and small wheels, as they permit 750 lb. per inch width or tire for a wheel 3 ft. 0 in. in diameter, with an increase of 100 lb. per inch width of the tire for each 12 in. increase in wheel diameter, and a deduction of 100 lb. per inch width in tire for every 6 in. reduction in diameter, with proportional increases or decreases in loading for amounts less or greater than the increments specified.

The speed of heavy motor cars must not exceed 8 mi. per hour if the unloaded weight of the vehicle does not exceed 3 tons, or if the maximum axle weight registered exceeds 6 tons. If the motor car draws a trailer the speed shall not exceed 5 mi. per hour, while 12 mi. per hour is allowed if pneumatic or elastic tires are used for cars not exceeding axle weights of 6 tons or less, and 8 mi. an hour for axle weights exceeding 6 tons. The minimum size of wheels allowed on heavy motor cars is 24 in.

In the state of Pennsylvania the load per inch width of tire is limited to 750 lb., and the maximum weights of a motor vehicle or trailer shall not exceed 12 tons. The width of vehicles must not exceed 7 ft. 6 in., except that motor buses within city limits may be 8 ft. 4 in. wide.

Many other states have special regulations regarding widths of tires. In Washington special regulations allowing greater unit loads per inch width of tire are permitted as the width of the tire increases, and increases are also allowed for increased diameter of wheels. This latter increase is an excellent one, as the greater diameter of wheel increases the bearing surface and renders less heavy the blow on any slight irregularity or defect in the pavement.

It is evident that there are many points to be studied in order to produce a satisfactory ordinance, and that much could be done to improve existing laws and regulations.

Pour Filler Over Blocks in Granite Pavement

Special Filler in Use in Baltimore Two Years Gives Excellent Results—Remains Firm in Summer and Resilient in Winter

FOR the past two years the City of Baltimore has used a special filler for its granite block pavements, which has given excellent service and is seemingly free from brittleness in winter and softness in summer. The filler is applied to the top of the joints and is poured over the blocks, and, combined with gravel, gives the pavement an asphalt-like appearance.

VARIOUS TARS AND ASPHALTIC FILLERS USED

In Baltimore a number of tars and asphaltic fillers have been used with varying success. Some were too brittle, others had no ductility and would not adhere to the blocks, thus allowing water to seep through the joints, to displace the sand cushion or cause freezing in winter weather. The filler finally adopted and at present in use is refined from Mexican crude oil and has the following characteristics:

Bitumen soluble in CS_2 .... = 99.80%
Bitumen soluble in CCl_4 .... = 99.80
Specific gravity at 60 deg. Fahr... = 1.042
Penetration at 32 deg. Fahr...... = 17
Penetration at 77 deg. Fahr...... = 45
Penetration at 115 deg. Fahr..... = 160
Ductility at 77 deg. Fahr......... = 60 cm.
Loss at 325 deg. Fahr.; 5 hours; 20 grams .... = none
Penetration at 77 deg. Fahr. after loss test .... = 32
Per cent hardened............... = 28.8
Melting point, cube method....... = 155 deg. Fahr.

In using the filler the granite blocks are laid with joints of not over ½-in. width, on a bed consisting of one part Portland cement to four parts of clean, sharp sand and having a depth of 1 in. The surface of the pavement is covered with hot torpedo gravel, which is swept into the joints to a depth of about 1 in. The blocks are then rammed, after which the joints are poured half full of the filler. They are then filled to within ½ in. of the top of the joints with torpedo gravel and again poured with the filler, which flows over the blocks and covers the entire surface of the pavement. Hot gravel is then spread over the surface, and, in a few hours, the road can be opened to traffic. It has been found by experience that the action of horses' feet and wagon wheels tends to pound the material into the joints.

Care should be taken to have the filler at a temperature between 375 deg. and 425 deg. Fahr., as it will not penetrate and fill all the voids if poured at a lower temperature. It is also imperative that the blocks be perfectly dry and free from dust, as the filler will not adhere to a wet or dusty surface.

At the intersections where the filler has been in service for two years the mat is still on top of the block, though spalled off in places, but not to any great extent. The appearance of the street is very much like that of sheet asphalt. In places where the mat has spalled off it has left a full flush coating of filler in the joints, giving an even surface to the granite block and fully protecting the edges. The filler was developed by Bruce Aldrich, chief asphalt inspector of the Paving Commission of the city. R. Keith Compton is chairman of the Paving Commission and consulting engineer.

Conservation of Operating Head Controls Design of Oaklyn (N. J.) Sewage Plant

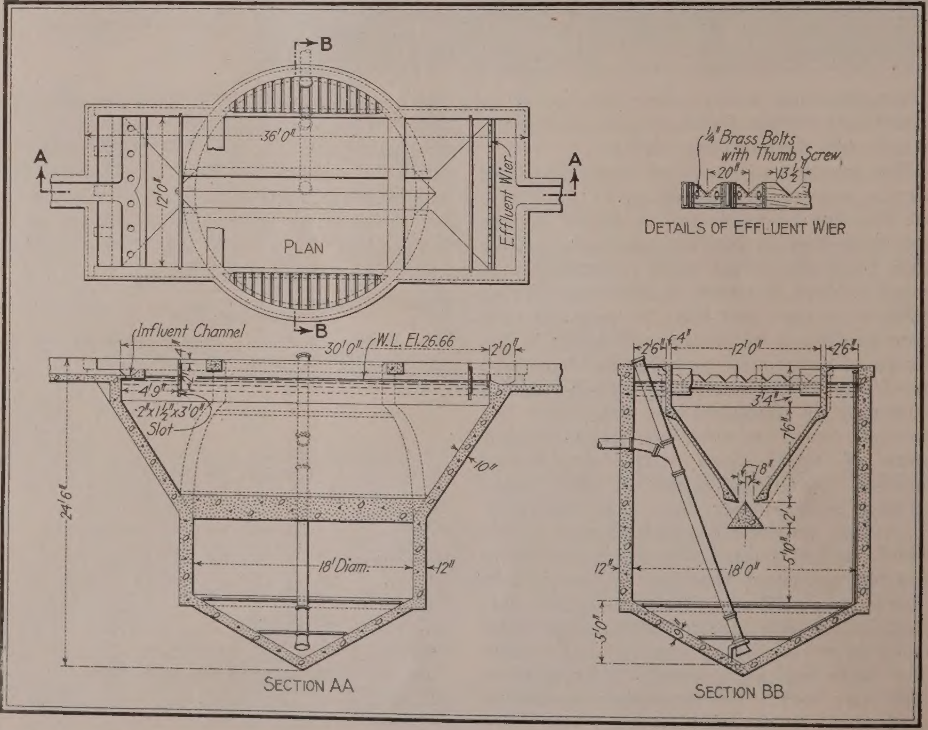
Gravity Installation, Consisting of Two-Story Tank, Sprinkling Filters and Secondary Settling Basin, Designed for 12½-Ft. Drop

By W. DE WITT VOSBURY
Of Remington & Vosbury, Consulting Engineers, Camden, N. J.

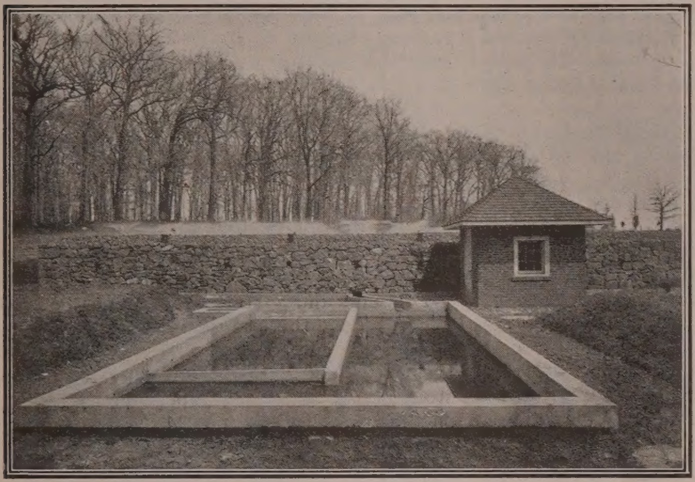
IN designing the sanitary sewer system recently constructed in the Borough of Oaklyn, N. J., it was found impossible to obtain, at the site selected for the disposal plant, a head greater than 12.5 ft. It was desirable, for various reasons, to construct a disposal plant consisting of a primary clarification tank, sprinkling filter and secondary settling basin, within the limitations imposed. A satisfactory design for a gravity plant of this type necessarily called for considerable study. As finally decided upon the drop was partitioned as follows: Flow line of primary settling tank to discharge level of water in dosing tank, 5 in.; to elevation of sprinkling nozzles, 4 ft. 3 in.; to flow line of secondary settling tank, 7 ft. 10 in. The total loss of head, therefore, was 12.5 ft. To keep within the head available for each portion of the plant it was necessary to conserve the drop in every possible way. Channels and troughs with circular inverts were adopted throughout and special care was given to the design of the dosing siphon and system of distribution piping to reduce the loss of head by friction.

As shown in the accompanying drawing, the primary settling tank is of the two story, horizontal flow type. It has a capacity of 170,000 gal. per 24 hr. with a 2-hr. detention period and consists of a hopper bottom, rectangular settling basin 12 ft. wide by 30 ft. long, which intersects a cylindrical chamber 18 ft. in diameter by 24 ft. in depth to the center of the conical bottom.

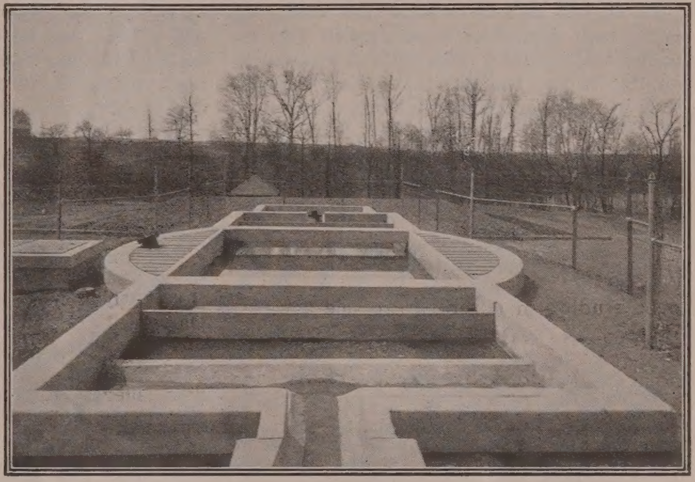
The segments lying outside of the partition walls of the settling compartments furnish the scum area. There are two 8-in. slots or openings betwen the upper and lower compartments of the tank. They are located at a depth of 9 ft. 6 in. below the water surface and extend across the cylinder parallel to the longitudinal axis of the tank. Protection against the gases from the sludge compartment entering the settling chamber is afforded by a concrete beam having a tri-



CYLINDRICAL FORM OF BODY OF TANK WAS DESIGNED TO AID CONSTRUCTION IN SATURATED GROUND angular cross-section, the bottom face of which overlaps the edges of the slots above by a distance of 9 in. The sludge chamber is designed to retain the accumulated solids from a population of 2500 for a period of six months.



THE SPRINKLING FILTER BED HAS AN AREA OF 3660 SQUARE FEET



TO MINIMIZE FRICTION LOSSES ALL CHANNELS HAVE CIRCULAR INVERTS

The cylindrical form of the body of the tank was adopted to facilitate construction. Many indications pointed to the presence of running sand and ground water in large quantities and to avoid the heavy expense incidental to sheathing and shoring at the depth required, as well as to reduce materially the amount of excavation and pumping necessary, it was the intention first to construct the cylinder complete at the surface of the ground and then sink it to place by excavating from the interior. Fortunately, however, during construction, subsoil conditions were encountered which made it unnecessary to follow the above procedure.

Distribution of the sewage as it enters the tank is secured by means of a transverse, circular-bottom, concrete trough overhanging and extending across the end of the settling chamber. In the bottom of the trough there are six openings each 6 in. in diameter, through which the sewage drops into the sedimentation chamber. Regulation of the flow through each opening is had by means of an adjustable, galvanized iron shutter, secured by bronze guides to the under side of the trough. This method of distribution has proven quite satisfactory as not only is an equal division of the influent throughout the cross-section of the tank readily obtained, but the trough is practically self-cleansing. Experience has shown that solids do not collect in it even under a greatly diminished volume of flow. At the effluent end of the tank the settled sewage is withdrawn through seven V-shaped weirs, made of No. 14 galvanized iron. The latter are slotted so that they may be accurately adjusted to position by means of thumb screws projecting from a notched cypress plank fronting the effluent trough.

Dosing Tank

From the settling tank the sewage is conveyed by a short circular-bottom channel to the dosing tank. The latter has an effective capacity of 1140 gal., equivalent to a depth of ½ in. of liquid on the surface of the filter bed. To attain as nearly as possible an even distribution of sewage during each dosing cycle, the bottom of the tank is tapered to conform to a theoretical curve, corrected to meet actual working conditions, representing the relation existing between the volume of sewage discharged and the area covered by the spray under the variable head. A 14-in. automatic siphon, operating under a 3-ft. draft, discharged the contents of the tank to the filter bed.

Filter Bed

In deciding upon the shape of the filter bed the make and type of nozzle to be used was first selected. The Taylor circular spray nozzle with a ⅞-in. orifice was used. With the characteristics of the nozzle and the working head known, the correct spacing was determined. The required effective area of the bed based upon a rate of filtration of 2,000,000 gal. per acre was 3646 sq. ft. The spacing of the nozzles, when located at the apices of a triangle with their maximum effective sprayed circles just touching, was 8 ft. 3 in. center to center in each row, with 7 ft. 2 in. between rows. By using nine rows with six whole and one half-nozzle to each row at alternate ends the dimensions of the sprayed surface of the bed became 66 ft. 10 in. wide by 54 ft. 10 in. long, or an effective area of 3660 sq. ft.

The piping system which distributes the sewage from the dosing tank to the nozzles was designed to eliminate, as far as possible, all losses by friction. Y-branches with ⅛-bends were employed in place of tees at the points where the lateral distributers branch from the main header. Universal cast-iron pipe, varying in size from 4 to 12 in., was used. Within the bed it was laid directly upon the filtering material without other foundation.

The filtering medium has a depth of 7 ft. and consists of 6 ft. of 1½ to 2½-in. crushed slag overlying a 12-in. layer of 4 to 6-in. slag covering the underdrains. For the latter, half-round 8-in. special perforated tile was used. The floor of the filter bed slopes uniformly, from both sides to the circular collecting channel at the center. The tile is laid in parallel rows, on the floor, 15 in. center to center, and as it extends from the above channel to the outside face of the vertical dry wall inclosing the bed, circulation of air is freely permitted. The central channel which collects the drainage from the bed and conveys it to the final settling basin is covered with concrete slabs resting on continuous concrete supports cast over and around the ends of the tile on either side of the channel.

The secondary sedimentation basin, which performs the function of collecting the settleable solids that pass from the filter bed, is 16 ft. wide, 30 ft. long by 3 ft. in depth, and was designed for a period of detention of 1 hr. A central concrete partition wall, which extends from the end nearest the filter bed to within 6 ft. of the opposite end, doubles the length of the flow line. The sewage enters the tank at the left of the division wall and after traveling to the opposite end returns on the right to the effluent weir. Distribution at the influent end is effected by a longitudinal cypress baffle extending nearly to the bottom of the tank.

A series of horizontal slots in the baffle diffuse the flow over the cross-sectional area at about mid-depth and the effect of a weir is thereby obtained. At the end of the partition wall on the right hand side of the tank a second baffle similar to the one already described re-distributes the flow after the sewage has made the turn. The sewage leaves the tank over a carefully constructed weir of green, glazed tile and enters the collecting trough alongside.

Disinfection

As the effluent from the plant is discharged into a small lake used for recreation purposes it was considered advisable to install further means of protection against possible contamination. Provision has, therefore, been made for chemical disinfection and a liquid chlorine apparatus was installed in a small brick chemical house located between the filter bed and secondary settling tank. As the apparatus is manually controlled, means for determining the rate of flow through the plant were necessary so that, when used, the chlorine might be fed in proportion to the sewage dosed. Neither the minimum flow nor available head was sufficient to warrant the use of a Venturi meter. A V-notched weir was, therefore, placed at the end of the collecting trough of the secondary settling tank and a 2-in. pipe used to connect the former with a float well in the chemical house. A 12-in. copper float and brass rod, to which a pointer is attached at the top, constitutes the recording apparatus. The rate of flow in gallons per day is indicated by the pointer against a scale graduated to correspond with the amount of water discharged by the weir at various depths.

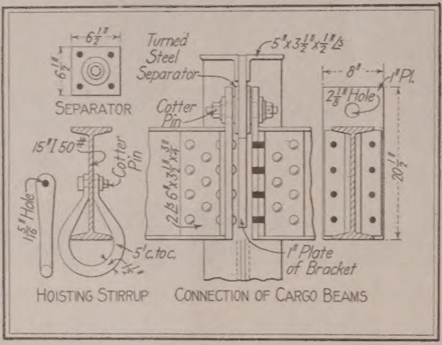
While the plant is constructed as symmetrically and compactly as possible, the design is sufficiently flexible to permit an increase in capacity when required. Attention was also given to general appearance and the place was made as attractive as possible, as a factor in gaining public confidence.

The plant described was constructed by the Kelley-McFeeley Company, of Camden, N. J., at a cost of approximately $11,000. Remington & Vosbury were the engineers.

Swinging Cargo Hoist Beams for New Pier Shed

I-Beams with Pin Connections Used Instead of Built-Up Girders in the New West Fifty-Seventh Street Pier in New York City

BY DESIGNING the end connections with pin details to allow the beams to swing into a position resulting in applied loads parallel to the webs only, it was found possible to use I-beams instead of built-up plate girders for the cargo hoist girders in the new West Fifty-seventh Street municipal pier to be built in New York City. This pier shed has the standard 20-ft. panels used in New York dock construction, is of the two-story type, with high 70-ft. cargo columns at each bay, similar to the construction used in the Forty-sixth Street pier described in the Engineering Record of May 27, page 708. The Fifty-seventh Street pier shed will be 700 ft. long and 110 ft. wide.



DETAILS OF SWINGING CARGO HOIST BEAM

The accompanying drawing indicates the details used in making the swinging connection to the bracket carried by the top of the column. A 2-in. pin placed above the ends of the beams passes through the 1-in. plate of the column bracket and through 1-in. plates riveted to the ends of the beams. The hoisting stirrups placed on 5-ft. centers are also a new design, looping around the lower flange of the I-beams as shown.

This design has been worked out under the supervision of Charles W. Staniford, chief engineer of the Department of Docks and Ferries, New York City, of which R. A. C. Smith is commissioner, and R. C. Harrison is deputy commissioner.

Denver and Philadelphia Typhoid Rates Similar for Years

Comparative data on typhoid death rates in two cities of such different characteristics as Denver and Philadelphia show a remarkable similarity for the last dozen years. This is even more marked since 1908. Philadelphia has been sterilizing the water since September, 1909, and Denver since July, 1911, every year showing a reduction in the rate for the latter city since 1910. For 1915 the Denver typhoid death rate per 100,000 was 6.7 and for Philadelphia 6.6.

As the Government Interprets Railroad Depreciation

Engineering Board, Division of Valuation, Ordinarily Bases Condition Per Cent on Ratio of Remaining to Total Service Life

THE views of the Engineering Board, Division of Valuation, Interstate Commerce Commission, regarding depreciation as submitted to Director Prouty last November, have recently been published in a statement issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee. The board believes that ordinary service condition per cent should be the ratio between remaining and total service life, and that mortality tables should be used on the straight-line basis. The general principles enunciated by the board are as follows:

1. Depreciation is the lessening in worth of physical property due to use or other causes.

2. Labor depreciates with the items of property of which it is a part.

3. Service condition per cent is the ratio between remaining capacity for service and total capacity for service in each cycle of use.

4. Depreciation shall be determined by a consideration of observations of actual conditions of the property and mortality statistics of similar property in like use applied where practicable on the straight-line basis.

5. Salvage is the net value which an article possesses for carrier purposes other than that for which the article was originally used.

6. Scrap is the net market value which an article possesses after its service for carrier purposes has been exhausted.

7. Normal life shall be the estimated average total service life under ordinary conditions.

GENERAL RULES

When depreciating property under the several accounts, the following general rules shall apply:

1. Ordinarily, service condition per cent shall be the ratio between the remaining service life and the total service life. When the depreciation of an item of property is based upon the weighted average of the parts, the service condition of each part shall be determined by this ratio.

2. When a normal life for a particular item of property has been prescribed for use in determining appreciation, that life must not be departed from unless an investigation of the records of the carrier or actual inspection in the field, or the two combined, warrant such departure. In no case shall a remaining service life of an item of property be taken at more than the prescribed normal life.

3. When no normal life is prescribed, the total service life and remaining service life shall be determined from observation of actual conditions and the examination of records and data from reliable sources.

4. Salvage and scrap will be allowed in cases where such values actually exist. Whether allowance shall be made in a given case for salvage or scrap shall be left to the discretion of the member of the Engineering Board. If an allowance is made this fact shall in all cases be stated upon the pricing sheet even though at the time the amount of the allowance cannot be given.

5. The service condition per cent as stated in the field record by the field man shall be subject to revision and final fixing by the member of the Engineering Board or his staff subordinates. The service condition per cent fixed in the field is assumed to be simply the statement of a fact.

HOW TO TREAT INDIVIDUAL ACCOUNTS

The board recommends that some of the accounts be treated as follows:

Engineering.—A small portion of the expenditure for engineering is connected with property which depreciates. In view of the fact that the larger portion is expended on location surveys, grading and other property which does not depreciate, and that the accounting records have been so kept in the past as to make it impracticable to segregate that portion of the expenditure which depreciates, the service condition per cent of the account shall be considered at 100.

Grading.—No allowance shall be made for appreciation or depreciation, as such, to excavation and embankment pay quantities of grading. Other property, such as breakwaters, bulkheading, retaining walls and similar items constructed of perishable materials shall be depreciated.

Tunnels and Subways.—The excavation of tunnels and subways including back-filling shall not be depreciated. Concrete and other masonry shall be given a normal life of 100 years.

Bridges, Trestles and Culverts.—(*a*) Metal bridges shall be given a normal service life of seventy years provided that the loads for which they were designed are not now being exceeded.

(*b*) Masonry culverts shall be given a normal service life of 100 years.

(*c*) Cast-iron culvert pipe shall be given a normal service life of eighty years, and other iron or steel pipe a normal service life of thirty years.

(*d*) Vitrified and concrete culvert pipe shall be given a normal service life of fifty years.

(*e*) Masonry piers and abutments shall be given a normal service life of 100 years.

Ties.—Where track has reached such a condition that the tie renewals are uniform in quantity and quality from year to year, the service condition shall be considered as 50 per cent. The average life of ties shall be determined by a study of the carrier records of tie renewals supplemented by a consideration of field observations.

TWO CYCLES FOR RAILS

Rails.—Rails shall be considered as having two cycles of life; viz., new to relay and relay to scrap. Each cycle shall be considered separately and have a range of service condition per cent of 100. The first cycle for a particular carrier shall be determined by a study of its rail renewals and the rail renewals of other carriers in the vicinity having similar traffic conditions. This cycle may vary upon different divisions of the same carrier where traffic conditions are different. A net salvage value shall be allowed for rails at the end of the first cycle equal to the price of relay rail at carrier's nearest material yard, less cost of bringing same from point where removed.

The second cycle shall be considered as having a normal life of fifty years.

When in depreciating relay rail the date relaid cannot be ascertained from records, the same shall be estimated from the best available data. Where rail was laid new in side tracks and will be used in this service until it becomes scrap, it shall be given a normal life of seventy-five years. Where the annual rail renewals in yards have become uniform in quantity and quality, a service condition of 50 per cent may be used.

A net price shall be assigned to scrap rail based upon the price of scrap at the carrier's nearest material yard, less the cost of bringing same from point where removed. The weight of relay and scrap rail shall be assumed to be the same as that of new rail.

Other Track Material.—(*a*) Splice bars shall be depreciated in cycles on the same basis as the rail with which they are used.

(*b*) Bolts shall be depreciated from new to scrap during each cycle of the rail with which they are used.

(*c*) Spikes shall be depreciated on the same basis as the ties with which they are used.

(*d*) Where average annual renewals of frogs and switches are uniform and conditions warrant, they may be depreciated on a 50-per cent basis.

(*e*) All other track material for this account shall be depreciated from new to scrap during each cycle of the rail.

Station and Office Buildings.—Timber structures shall be given a normal service life of sixty years and masonry structures 100 years, suitably modified where observation shows principal parts are new or in need of renewal.

EQUIPMENT

Steam Locomotives.—Steam locomotives shall be depreciated according to the general rules. The percentage finally established as representing the present service condition of each locomotive shall be the weighted average of the assigned condition per cent of the following principal parts: Engine—(*a*) boiler, (*b*) underframe, (*c*) running gear; tender—(*a*) trucks, (*b*) underframe, (*c*) tank. (The same rules are to be used for other locomotives.)

Freight-Train Cars.—Freight-train cars shall be depreciated according to the general rules. A service condition shall be established for each series of cars which shall be the weighted average of those cars of the series actually inspected. Not less than 10 per cent of the cars of each series shall be inspected for condition, and a larger percentage where a series contains a small number of cars, or if the cars in a series vary greatly.

The service condition per cent established for each car inspected shall be the weighted average of the service condition per cent assigned to the following principal parts of the car: (*a*) Body, (*b*) underframe, (*c*) trucks.

Passenger-Train Cars.—Passenger-train cars shall be depreciated according to the general rules. Each passenger-train car shall be separately inspected to determine service condition, following the same general rules set forth in Account 53 (freight-train cars).

Tracklaying and surfacing, the recommendations state, should be depreciated with the material composing the track, the depreciation to be determined on the basis of the depreciation weighted according to the labor costs assignable to the materials of the several accounts. Iron wire for telegraph and telephone lines should be given a normal service life of 50 years and copper wire one of 100 years. Property coming under all other accounts should be depreciated under the general rules.

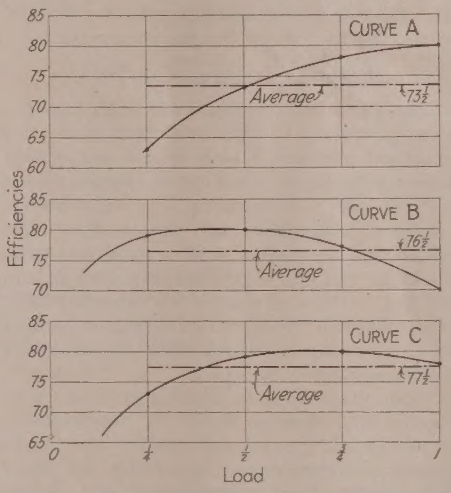
Average Efficiency of Waterwheel Influenced by Size of Bucket

Quotient Derived by Dividing the Pitch Diameter by the Jet Diameter Conveys Good Idea of Performance of Impulse Wheel

By JOHN S. CARPENTER
Hydraulic Engineer, Pelton Water Wheel Company

BY plotting a curve, using as the ordinates the specific speeds of waterwheels of the impulse type and as abscissæ the ratio of the pitch diameter to the jet diameter, it will be noticed that it will assume the form $ab = c$, the last being a constant. Thus it is shown that, by dividing a constant by the ratio of the pitch diameter to the jet diameter, the specific speed may be obtained and vice versa. But, while the specific speed conveys in a general way to the designer whether the resulting runner will be of high or slow speed, a quantity having for its value the quotient of the pitch diameter divided by the jet diameter conveys at once a good idea of the finished wheel, the number of buckets necessary and whether the buckets will be crowded or relatively wider spaced.

By use of the following notations the formulæ for obtaining specific speed relations may be derived either in English or metric terms.



SIZE OF BUCKET SHOULD BE PROPORTIONAL TO THAT OF JET

H = effective head in feet; h = the same in meters.

N = horsepower, n = revolutions per minute.

D = diameter in inches of runner on pitch circle; d = the same in meters.

$\triangle$ = diameter in inches of the jet; δ = the same in meters.

n_s = specific speed or type characteristic.

$R = \frac{D}{\triangle} = \frac{d}{\delta}$ or briefly, "ratio."

φ = velocity on the pitch line divided by jet velocity, a decimal, generally from 0.42 to 0.47.

The diameter of the runner D on the pitch circle in the English system is:

$$D = \frac{8.02H^{1/2}\varphi 12 \times 60}{\pi n} = \frac{1838H^{1/2}\varphi}{n} \qquad (1)$$

and in meters:

$$d = \frac{4.43H^{1/2}\varphi 60}{\pi n} = \frac{84.6H^{1/2}\varphi}{n} \qquad (1a)$$

and the diameter of the jet at 80 per cent total efficiency is given in inches by

$$\triangle = \sqrt{\frac{N \times 11 \times 144}{H 8.02H^{1/2} 0.7854}} = \frac{15.91N^{1/2}}{H^{3/4}} \qquad (2)$$

and in meters

$$\delta = \sqrt{\frac{N \times 0.095}{H \times 4.43 \times H^{1/2} \times 0.7854}} = \frac{0.1653N^{1/2}}{H^{3/4}} \qquad (2a)$$

To find the value of R, divide the diameter of the runner on the pitch circle by the jet diameter.

$$R = \frac{D}{\triangle} = \frac{1838H^{1/2}\varphi H^{3/4}}{nN^{1/2}15.91} \qquad (3)$$

$$R = \frac{d}{\delta} = \frac{84.6H^{1/2}\varphi H^{3/4}}{nN^{1/2} \times 0.1653} \qquad (3a)$$

The specific speed is given by

$$n_s = nN^{1/2}/H^{5/4} \qquad (4)$$

Multiplying equations (3) and (4)

$$\frac{D}{\triangle} n_s = \frac{1838H^{1/2}\varphi H^{3/4}nN^{1/2}}{nN^{1/2}15.91H^{5/4}} = 115.5\varphi \qquad (5)$$

or in meters

$$\frac{d}{\delta} n_s = \frac{84.6H^{1/2}\varphi H^{5/4}nN^{1/2}}{n0.1653N^{1/2}H^{5/4}} = 511.92\varphi \qquad (5a)$$

Consequently, it is seen that in the English system

$$Rn_s = 115.5\varphi;\ R = 115.5\varphi/n_s \text{ and}$$
$$n_s = 115.5\varphi/R \qquad (6)$$

and in meters

$$Rn_s = 511.92\varphi;\ R = 512\varphi/n_s \text{ and}$$
$$n_s = 512\varphi/R \qquad (6a)$$

The value of φ depends upon the bucket. If the bucket is ground and polished inside and the linear dimensions are not too large φ may go up to 0.465, but for hydraulic surfaces with foundry finish it is not advisable to go above 0.43. Based on a jet velocity of $0.98\sqrt{2gh}$, this shows a friction loss of $(0.465^2 - 0.43^2/0.98^2)\ 100 = 3.23$ per cent, which has been verified by tests.

The following table gives an idea of the comparative values with φ at 0.45 and 80 per cent efficiency:

	English	Metric
R	n_s	n_s
7	7.43	32.90
8	6.50	28.80
9	5.78	25.60
10	5.20	23.00
11	4.73	20.94
12	4.33	19.20
13	4.00	17.73
14	3.72	16.46
15	3.47	15.36
16	3.25	14.40
17	3.05	13.55
18	2.89	12.80
19	2.74	12.13
20	2.60	11.52

From investigations by the writer it would appear that a ratio R of about 10 is as low as an efficient unit should go, counting first cost, loss in revenue due to decreased efficiency, etc. Such a unit would have a specific speed of 5.20 English or 23 metric. A runner with $R = 10$, but with two jets, has an equivalent R of $10/\sqrt{2} = 7.07$ or a specific speed of $5.20\sqrt{2} = 7.35$ English or 32.5 metric. In such a case, viz., a wheel with more than one jet, the comparative R varies inversely as the square root of the number of jets, and the equivalent specific speed directly as the square root of the number of jets.

There seems to be an unfounded prejudice against wheels with more than one jet, due probably to the jets being too close together and the lower jet often projecting the water nearly vertically against the upper housing.

The jets should be not less than 60 deg. apart, and preferably one should be horizontal and the other 60 deg. above it. In any case the first cost is generally less by one runner in a unit with two wheels and two streams than in a unit with one wheel and two streams.

When one compares specific speeds there goes with it also the thought of efficiency. All other things being equal, the linear dimensions of the buckets play an important part. Some designers make a bucket "large" in order "to be sure that they get the power." This only moves the point of maximum efficiency farther up the curve, thereby decreasing the average efficiency of the unit, or in other words, its commercial value.

Curves Taken from Actual Tests

An examination of the efficiency curves in the drawing will show some important points. These curves are taken from actual tests and, as only the general law of the curve is pertinent to this discussion, maximum efficiencies have all been reduced to 80 per cent for comparison.

The curve A shows too large a bucket for the jet. The maximum efficiency, therefore, would, judging from the law of the curve, be found at about 50 per cent overload. The area of the jet should be 33 per cent larger in proportion to the given bucket at full load. Curve B shows an overloaded bucket, the area of the jet being about 25 per cent too large. Curve C is typical of the best designed units. The average efficiency for each curve is indicated—for one-fourth, one-half, three-fourths and full loads.

While all the curves have been reduced to 80 per cent maximum efficiency to show the advantage of the three different shapes, it is seen that C is 4 per cent better than A, all of which has a direct bearing on the revenue, showing the value of a flat curve with the "hump" or maximum at from 60 to 70 per cent of the maximum rating.

Efficiency Curve Should Be Criterion

There can be no doubt that the efficiency curve and the regulation guarantees should form the basis of comparison for purchase; for this the average efficiency of one-fourth, one-half, three-fourths and full loads is the best criterion of quality and performance.

It may also be said that curves B and C have the advantage of being usually better than the proportion of 4 per cent cited above in the case of C over A, due of course to the fact that A is still increasing.

Tests made at a testing station at Charlottenburg, Germany, by Prof. W. Wagenbach and Prof. Dr. Ernst Reichel, on carefully designed low-speed wheels with polished buckets gave for specific speed 21 (4.75 Eng.) to 32 (7.23 Eng.) efficiencies of 88 and 80 per cent respectively. Tests on the same kind of high-speed wheels (principally longer buckets radially) gave 85 per cent at 25 n_s and 83 at 35 n_s (5.65 and 7.9 English respectively).

Taking the low favorable limit of n_s for Francis turbines at 60 metric (13.55 English) and remembering that n_s varies directly as the square root of the number of jets, it is found that a unit with four jets is $60/4^{\frac{1}{2}} = 30n_s$ *or* 6.77 English. This unit should be made with two wheels and therefore two jets per wheel.

Assuming that the wheels were well designed, and allowing say 4 per cent as a margin, the wheels should have 80 per cent at $n_s = 30$ or 6.77 English.

Test Compounds for Making Wood Fire-Retardant

Herman and Arnold Von Schrenk Report Preliminary Investigations Made for Comparison of Various Commercial Materials

WHILE insisting upon the insufficiency of the results so far obtained and the necessity for planning a larger series of tests, Herman and Arnold Von Schrenk in a recent preliminary report to the National Lumber Manufacturers' Association conclude that practicable standard methods for fire tests can be developed, and that the tests so far conducted have been worth while in showing that there are a certain number of compounds claimed to make wood fire-retardant from which reliable results may be expected. Fifteen compounds for rendering shingles fire-retardant and eighteen compounds applied to yellow-pine panels were tested, and the results were tabulated and discussed in detail in the report. The following abstract suggests the method of testing and the principal conclusions.

Object and Method of Tests

The tests were undertaken with two objects in view: (1) The development of some practical methods which would lend themselves to general adoption as standard for testing and investigating the characteristics and efficiencies of various materials which can be used to render wood less combustible, and (2) a preliminary comparison of the merits of materials commercially offered at the present time as fire-retardant or fireproofing products when tested under similar conditions.

Tests were made in a testing furnace similar to that used by the U. S. Forest Products Laboratory and described in the Tenth Annual Proceedings of the American Wood Preservers' Association, page 158. In all the tests the heating plate of the furnace was brought to a constant temperature of 450 deg. C. This temperature was adopted after numerous trials as one which was severe enough practically to destroy the untreated pieces as well as those coated with the less resistant of the test materials, and still permit of a general grading upward to those having the highest resistance.

The method of testing was to expose the test pieces to the heated plate at a distance of ¾ in. from the latter, and flash a gas jet in front of the piece every 10 sec. until ignition took place. The piece was then permitted to burn for 12 min. without its position being changed; then, if still burning, it was moved back from the plate and allowed to burn 12 min. longer, or until the flame was out. The length of time which elapsed from the first exposure to the heated plate until ignition took place, the duration of burning next to the heated plate and away from it and the manner in which the burning took place were noted.

In an investigation of this character it is obvious that the first tests made must be considered as preliminary. The relative values given to the different fire-retardant substances may be very considerably changed by subsequent work. The main conclusions which can be drawn from the determinations so far made are that these tests have indicated that there are a certain number of compounds used for the yellow-pine panels from which reliable results may reasonably be expected. In the case of compounds for shingle protection, while the number is not so large, there appears to be a sufficient number to warrant the statement that when efficiently applied they will not only give a high degree of fire-resistance to a shingle-covered roof, but will also serve to reduce materially, if not entirely eliminate, the flying-brand hazard of the wooden shingle roof.

The investigation has shown in a very striking manner that the numerous variables which enter into the proper consideration of this problem will necessitate greatly enlarging these studies. Practical experience with the fire-testing apparatus has demonstrated that while it is highly efficient it could probably be very considerably improved. It is necessary to have a standard method of testing which will be absolutely reliable.

While the results obtained in the testing furnace are of great significance it will be absolutely essential to construct shingle roofs, as well as other wooden structures, in large numbers, treated with compounds which show the best indications at the present time, exposed to normal weathering conditions and from time to time subjected not only to tests in the furnace but also to standard tests on a large scale.

Design Needle for Road Material Penetration Tests

IN an effort to obtain a needle for road material penetration tests, which will give results in close accord with existing standards and which may be accurately described and easily reproduced, Charles S. Reeve and Fred P. Pritchard of the U. S. Office of Public Roads and Rural Engineering have produced, after the following manner, a needle which has given satisfactory results:

The needle is made by placing a 2-in. length of 0.041-in. annealed-steel drill rod in the chuck of a high-speed lathe, and by means of a fine sharp file turning the end to a sharp point having a ¼-in. taper. When it has been made as smooth and sharp as possible by this means the needle is tempered in a solution consisting of 5 teacupfuls of common salt, 6 ounces of saltpeter, 12 teaspoonfuls of powdered alum and 1 teaspoonful of corrosive sublimate dissolved in 10 gal. of water. The needle is tempered by heating carefully to a dull white heat and plunging at once into the tempering solution. It is then lightly cleaned with smooth emery cloth, heated carefully to a point below dull redness, and again plunged into the solution. It is then ground to a sharp point with a good stone, after which it is smoothed and polished with emery dust, crocus cloth and rouge, and finally held carefully on a buffing wheel. The finished needle should be sufficiently smooth and sharp to enter and pass through a piece of ordinary writing paper without sticking or friction. In other words, the needle must have as sharp a point and smooth a surface as any sewing needle. The important thing is to have the taper straight, beginning ¼ in. from the end, and the needle above the taper exactly 0.04 in. in diameter.

HERRON AVENUE VIADUCT AS IT APPEARED LAST NOVEMBER, WITH MAIN SPAN REMOVED

Single Grade-Crossing Elimination at Pittsburgh Will Cost $750,000

Maintaining of Traffic at Liberty Avenue Crossing of Baltimore & Ohio Railroad an Unusually Difficult Problem

HEAVY railroad traffic on a double-track line, with the view to the east cut off by a sharp curve; heavy street traffic, over a narrow, poorly paved roadway, with a double-track street car line, a steep hill just beyond the crossing, and driveways turning off along the railroad on both sides—all contributing to the congestion of trucks; lack of storage space for construction materials because of narrow right-of-way; lack of opportunity to shift tracks because of narrow right-of-way and because at the west line of the street the railroad passes upon a long steel viaduct; and the necessity at just this point of placing deep foundations to protect an 8-ft. city sewer that meanders through the whole scene of action—all of these things combine to make the intersection of Liberty Avenue and the Baltimore & Ohio Railroad in Pittsburgh, where a separation of grades is being effected, about as busy and cramped a spot as the most ingenious construction man would care to contend with. The necessity of raising the above-mentioned viaduct and part of the Allegheny River bridge on the west, and of protecting the sewer and holding the embankment with retaining walls on the east, will bring the cost of eliminating the single grade crossing to an estimated figure of $750,000. The construction problems are mainly those of maintaining a dense steam, electric and vehicular traffic. Design features include the footings bridging the sewer, and the construction of the new viaduct in such a way that the floor system can be raised to conform to an ultimate higher profile without interrupting traffic.

PRESENT CONDITIONS

The railroad involved in this work is the main double-track line of the Baltimore & Ohio from Pittsburgh to Chicago. Liberty Avenue is one of the two main thoroughfares from Pittsburgh's business district to the East Liberty residential section. West of the avenue the ground drops off and the railroad is carried in Thirty-third Street on a viaduct about 1800 ft. long, from the west line of Liberty Avenue to the Allegheny River bridge. This viaduct is approximately level. East of the avenue the railroad swings into a natural depression, climbing up along the bottom of this on a grade of upward of 1 per cent. Along this part are numerous industries on both sides of the track, in addition to which there are a 40-ton traveling crane for handling heavy freight on the north side and a small freighthouse and team yard on the south side adjacent to Liberty Avenue. These are reached by driveways turning off Liberty Avenue along the tracks on either side.

Liberty Avenue, a comparatively narrow and poorly paved street, carries a heavy vehicular traffic as well as a double-track line of the Pittsburgh Railways Company. Just north of the crossing it makes a sharp ascent to the turn at Forfar Street. This ascent, the bad pavement and the sharp turns into the driveways on either side of the tracks all tend to cause vehicular congestion.

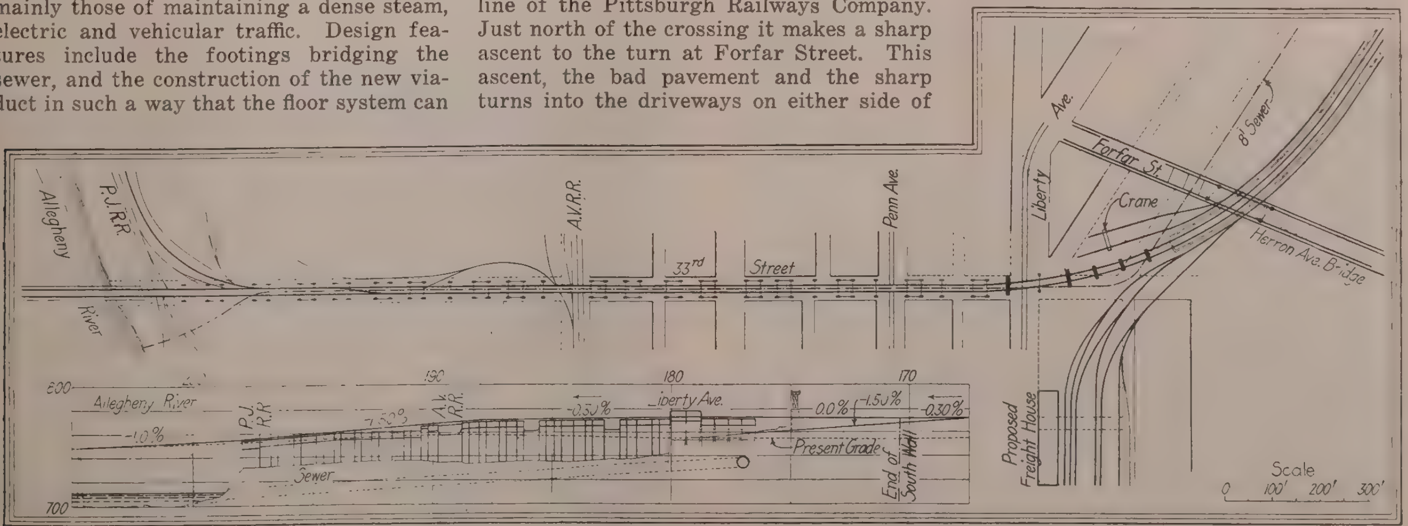
About midway between Liberty Avenue and the Allegheny River the viaduct passes over the main tracks of the Allegheny Valley Railroad, and it also passes over the Pittsburgh Junction Railroad along the river. These two low-level railroads are connected by the Carnegie Steel Company's tracks under the viaduct. These tracks have to be accommodated in any reconstruction of the viaduct. Under Thirty-third Street there is also an 8-ft. circular sewer, the path of which east of Liberty Avenue is shown on the general plan.

At Forfar Street a viaduct known as the Herron Avenue bridge carried street traffic over the railroad prior to the beginning of the improvement. The raising of the tracks has necessitated raising this viaduct in part and reconstructing it in part, and this work is now going on, the viaduct being closed to traffic.

The foregoing were the existing conditions before the improvement was started. To eliminate the grade crossing without changing the railroad profile would have meant heavy damage claims in connection with the raising or lowering of Liberty Avenue. It would also have perpetuated a bad profile for the railroad. By raising the tracks practically the full amount at the crossing, the heavy grade east of the crossing will be to a large degree eliminated, and the railroad will be in a position, when it ultimately rebuilds the Allegheny River bridge, to build it considerably higher as required for the proposed Allegheny River improvement.

WORK INVOLVED

The railroad will be raised at the crossing about 18 ft., the street being depressed about 2 ft. The viaduct west to the river is being reconstructed. The tracks will descend part way on a 0.3-per cent grade, which will ultimately be extended to the high-level bridge over the river. For the time being, however, the high profile will be connected to the existing bridge by a short 1.5-per cent grade, which will necessitate slightly elevating the deck on one span of the river bridge. East of the crossing the tracks will be about level until they pass under the Herron Avenue bridge and around the 6½-deg. curve at that point. They will then ascend on a 0.3-per cent grade, compensated, to a point where this grade is overtaken by the steeper grade of



PLAN OF AREA AFFECTED, AND PRESENT AND PROPOSED PROFILES OF TRACKS—EAST APPROACH RUNS OUT 3000 FEET EAST the present profile. This approach will be 4000 ft. long. The two main tracks will be held up by retaining walls to protect the low-level industry tracks on the north side and the lead to the freighthouse and team tracks on the south side. On the south side the retaining wall terminates at the east end of the curve; on the north side it will extend nearly to the end of the approach.

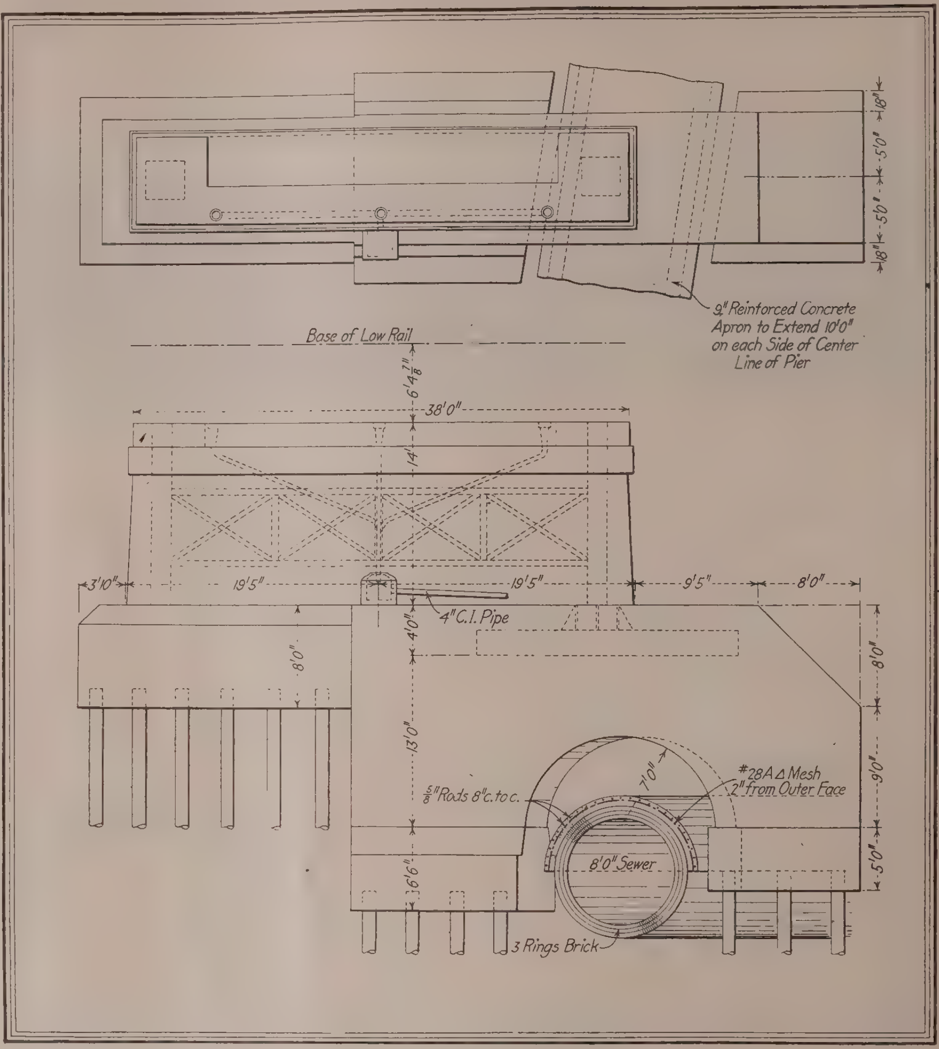
The earth fill will terminate 300 ft. east of Liberty Avenue, and over this intervening space the tracks will be carried on concrete piers and steel girder spans. This is for the double purpose of allowing teaming underneath to and from both yards, and affording protection to the 8-ft. sewer. The small freighthouse and team yard standing oblique to Liberty Avenue will be replaced by a larger layout parallel to the avenue, as shown.

First Stage of Work

The construction work was begun last September. The main tracks east of Liberty Avenue were first thrown to the north far enough to clear the south retaining wall, which was then built, on concrete piles. These walls are of standard mass construction, the concrete being placed by the pneumatic process. Steel forms are being used, handled by the special traveler shown in one of the views.

This south wall was completed during the winter, and late in February main-line traffic was shifted to a single track laid south of the new wall. It was hoped to retain one track north of the north wall as a westbound main, but it was found impossible to keep this open all the way through. Of the two photographs taken from the same point, the one on the left, taken Feb. 21, shows the former location of the two main tracks, with the westbound still in service. It also shows the eastbound track swung out to the south of the south wall. The other view, taken eleven days later, shows this latter track doing duty as the only main track, and various equipment preparing the foundations for the piers along and over the 8-ft. sewer.

The north retaining wall was being built when this journal's representative visited the work. Meanwhile the main track beyond the south wall was being filled under traffic, and the next shift, which was to come immediately after the completion of the north wall, was to be to a high-level trestle swinging to the north of most of the masonry in the piers east of Liberty Avenue.

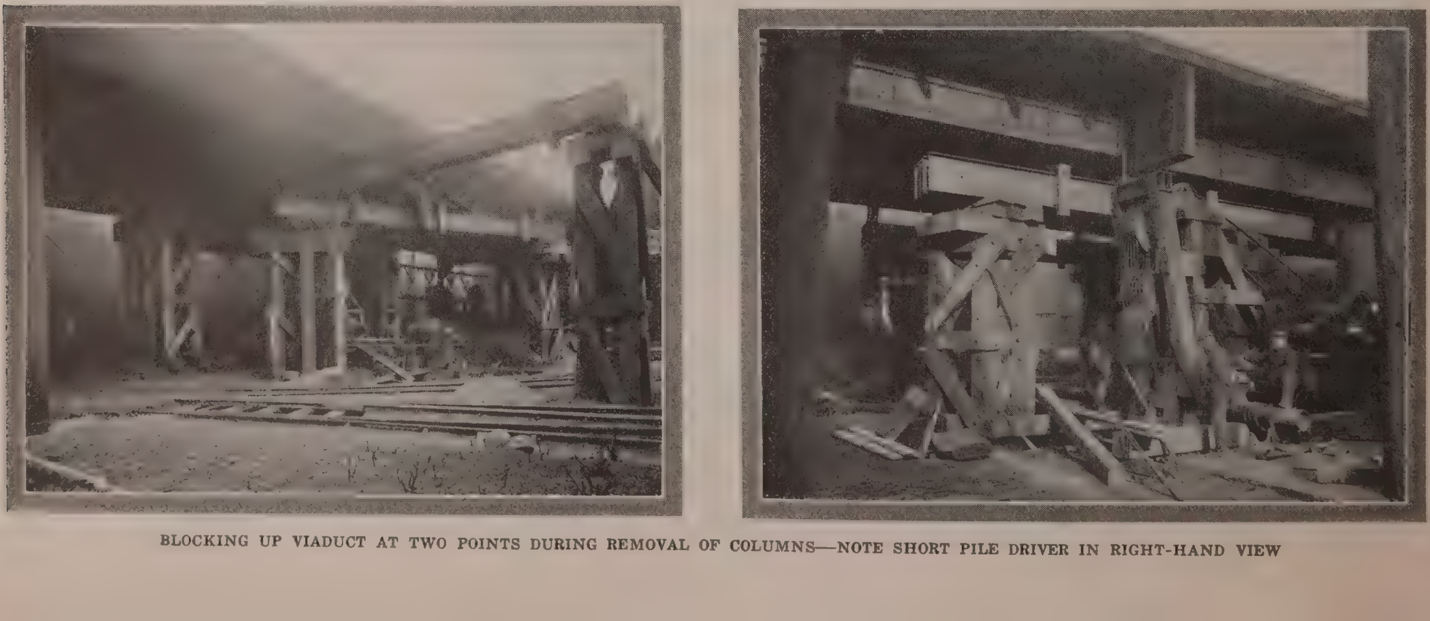


DETAIL OF PROVISION TO CARRY 8-FOOT SEWER UNDER END OF PIER

Straddling a Large Sewer

Of these piers, each had to be designed to take care of the sewer. The first of these from the east is swung around perpendicular to the sewer, and arches it practically symmetrically. The sewer clears the next two. A detail of the fourth is shown. The sewer passes directly under the south end of the pier proper, which has a structural steel skeleton. The north column of this skeleton will, as indicated, be carried on an ordinary foundation on piles; the south end will be supported on an enlarged footing arched over the sewer. The bent just east of the avenue will be carried on a pedestal each side of the sewer. The foundations of these piers and pedestals are now being constructed of solid concrete masonry on precast reinforced concrete piles.

The changes in the Herron Avenue bridge are being made by the city. One of the photographs suggests what was required.



BLOCKING UP VIADUCT AT TWO POINTS DURING REMOVAL OF COLUMNS—NOTE SHORT PILE DRIVER IN RIGHT-HAND VIEW

The deck structure spanning the tracks would not have given the necessary clearance over the elevated tracks. It had to be removed and two new piers had to be built for the remodeled structure, which will have a shallow span over the tracks. Some of the adjoining spans have been raised slightly, but the new roadway will not be much higher than the old.

RAISING 1800 FEET OF VIADUCT WEST FROM CROSSING

While the work east of Liberty Avenue has been going on the piles and footings for the new viaduct west to the river have all been placed. Except in a few cases these have been set clear of the existing columns and tracks, and no special difficulties were encountered, except that it was necessary to drive the piles with a driver only 12 ft. high over all. A view of this is shown in one of the photographs. In some cases it was necessary to place new footings on the site of the old, supporting the viaduct structure after the manner shown in the photographs.

FEBRUARY 21 TWO MAIN TRACKS WERE IN SERVICE →

MARCH 3 THERE WAS SCARCELY ROOM FOR ONE ←

Because the 1.5-per cent grade at the west end of this viaduct is ultimately to be eliminated when the new high-level bridge over the Allegheny River is built, it was found desirable to design the new viaduct structure to conform as far as possible with both profiles. For part of the distance this will be accomplished simply by framing the stringers between the cross girders, and taking them out and putting them on top of the girders when the tracks are raised.

At the end nearest the river it will be necessary, in addition to placing the stringers on top of the floorbeams, to place castings underneath the stringers, and in some cases also to raise the floorbeams slightly. The columns will be extended at this time to provide for such future raising of the floorbeams.

The improvement is being carried out under the direction of F. L. Stuart, chief engineer of the Baltimore & Ohio Railroad at Baltimore, and Paul Didier, principal assistant engineer at Pittsburgh. Claude Brown, assistant engineer, is in immediate charge on the ground. P. J. Joyce & Company, Inc., of New York, has the general contract, and is represented at the site by Mr. Joyce. The pile driving for the entire work was sublet to the Cranford Construction Company of Cincinnati. The American Bridge Company has the contract for the steel.

Maintaining the Washington-Atlanta Highway

Data on Organization and Cost of Maintenance of Project Under Supervision of Federal Office of Public Roads

SINCE May, 1914, 800 continuous miles of highway between Washington, D. C., and Atlanta, Ga., has been maintained under the direction of the U. S. Office of Public Roads. The plan was put into effect in order to demonstrate what could be done with road repair and maintenance on a large scale. The work necessitated the assignment of four engineers, three of whom took charge of the divisions between the two cities. The project has been carried on with remarkable results, according to L. I. Hewes, of the Office of Public Roads, from whose paper in the Cornell University highway short course the following notes on organization and costs are taken:

CONDITION OF ROAD

In order to make the project possible, approximately thirty-seven counties entered into a specific agreement to allow the expenditure of that proportional part of the county funds applicable to the selected route to be under the sole authority of the Office of Public Roads, and during 1914 681.8 miles of the total route came under the plan; $75,786 was available from the various counties. On 153.7 miles operations properly classified as construction were completed, and used up a little over one-half of the funds above mentioned. A total of 139.5 miles was placed under a squad system of maintenance and 263 under patrol system.

The construction operations extended from systematic patch-work to extensive grading and drainage. Almost the entire stretch of road was of low type construction, namely, earth, sand-clay, or gravel. In the State of Georgia during 1914 none of the road was in condition for maintenance in these counties that signed application for government supervision. Construction work only was completed. On most of the road the greatest single defect was drainage. Sub-drainage was almost completely absent. Nevertheless, it was possible to keep nearly the entire mileage in fair to excellent condition until Christmas, 1914. For about 60 days following the winter, rains and water caused bad conditions. The engineers, however, would keep on their sections and whenever possible prompt attention was given to repair and maintenance items. The road became again generally good by the first week in February.

SYSTEM DEFECTIVE

It was found that the system prevailing in the various local units rather than the personnel of officials was defective. Suspicion and distrust soon yielded to substantial co-operation and support by business men and responsible citizens. A general scheme of county-road accounting became very desirable.

In many cases funds ran out at the end of seven months, and many county officials were unable to tell whether or not expenses for other roads had been drawn against the allotment. It appeared in general that county officials had a certain variable sum allotted for road work from year to year. They could go ahead and spend it until it was gone; bills received before the exhaustion of the fund were settled, others waited until the next year. This system made it impossible to carry out plans with any degree of certainty. Results accomplished under the systematic supervision outlined above were in many instances in spite of ridiculously low appropriations. In Brunswick County, Va., for instance, 104 pipe culverts occurred in 23 miles. There was available but $2.50 per mile per year for cleaning ditches, culverts, shoulders, and repairing, surfacing and dragging.

PRESENT CONDITION OF PROJECT

The results have in general been very satisfactory. As expected, continuous organization and centralization of maintenance have markedly improved the general condition of the road between the two cities. Sentiment has been directed toward better organization and methods. Applications have in general been renewed for government supervision to continue. It has been found that convicts in gangs do not constitute an effective organization for systematic maintenance. In Georgia it was necessary to continue heavy repair and construction work rather than maintenance, as the roads could not be brought into condition to maintain without using the available money first for heavy repairs. Approximately $42,000 was spent during the past season, and only $18,000 on maintenance, applied largely to the road built the previous year. The total mileage now under supervision is 662. The total amount spent during 1915 was $146,762.

It has not been found necessary to change the general organization. The division engineer of the north division cares for 243 miles, from Blackstone, Va., to Fayetteville, N. C. The division engineer of the middle division, from Fayetteville, N. C., to Augusta, Ga., has 269 miles. The south division, from Augusta to Atlanta, has 306 miles. Each division engineer inspects his work continuously in an automobile. In nearly every county of North Carolina private subscriptions have been made available, in addition to road appropriations. During the winter of 1915 there has been no obstruction to traffic, except for one day at a point near Boydton, Va., where the convict gang placed clay in January and a heavy rain followed. This defect was repaired in 24 hr. by the addition of sand and dragging.

Conclusions and Costs

It has been found necessary to do a huge amount of miscellaneous construction, including projects of various sizes and kinds, culverts, new location, grading, etc. This work was absolutely necessary to put the road in reasonable condition for a maintenance project. It has been found that certain stretches of the road sustain too much traffic for the type of surface prevailing. On such stretches a patrol is absolutely necessary to keep the road in reasonable condition, and is more effective than the gang system, which works intermittently.

In eight selected counties, in which the mileage varied from 15 to 38, it was found possible to classify the work as truly maintenance work, both in 1914 and 1915. The cost during 1914, in these eight counties, varied from $98 to $34 per mile; in 1915, from $146 to $51 per mile. The increase in 1915 is due to the fact that more funds and better maintenance were available. The calendar year 1915 closed with 39 counties in operation, 662 miles in these projects, out of a total of 876 between the two cities. A total of 277 miles is under the patrol system of maintenance, and 274 miles under the squad system. In general, considering the results obtained, the continuous patrol system seems to have an advantage where the roads are traveled as heavily as are many sections of this highway, namely, from 24 to 35 automobiles per day. There are at present at work 13 patrolmen, and about 60 men in gangs of from 4 to 12. The patrolmen have an average of about 12 miles each of road; the gangs will average 18 miles. Patrolmen are paid $1.50 per day, and an extra dollar when they use two horses for the drag. Wages for men in gangs are also $1.50 per day, with $2 to $2.50 for foremen. It has been found that the two-horse scraping grader is very economical and efficient to supplement the drag.

Patching Concrete Pavements

The patches in concrete pavements at Gary, Ind., are allowed to set for 48 hours after placing. A tar covering, at the rate of ½ gal. to the yard, is then put on the patch and traffic turned on at once. Experience has shown that the method is satisfactory. The tar wears off in six or seven months, and the concrete patches are thoroughly hardened.

Largest Panel-Testing Furnace in This Country Constructed at Washington

U. S. Bureau of Standards Provides Heavy Steel Panel Frames and Trolley Runways for Testing Various Types of Fire-Resistive Construction

FOR THE PURPOSE of making fire-and-water tests of large panels of fire-resistive walls and partitions of various types the U. S. Bureau of Standards has designed and erected a test house accommodating twelve panel-testing frames of greater size than any in this country. The furnace is guaranteed to develop practically uniform temperatures between 1400 and 2400 deg. Fahr., with variations within 40 deg. from the desired figure. The burner is specially designed for this installation, and burns light oils without the necessity for previous heating.

General Plan of Building

To properly house the furnace, store and handle the twelve steel panel frames which are to be furnished, and provide for the application of the fire-hose stream necessary for these tests a steel-frame building about 37 x 85 ft. in plan has been built. This structure is to be divided by partitions into three sections, the furnace in one end, the crane runway for transferring the panels in the center, where the water is to be applied and drainage facilities are provided, and the storage room at the other end, where the frames are carried on I-beam runways and stored before testing.

The steel frame of H-column and typical Fink roof trusses with corrugated steel roofing is braced by 1-in. diagonal rods with turnbuckles, not only in the outside panels, as shown in the photograph, but in the intermediate panels between the columns supporting the steel racks, to prevent excessive bending stresses in the columns from the handling of the heavy frames—the total weight of the heaviest frame and panel being about 25 tons. Horizontal bracing also is provided above the 18-in. 70-lb. trolley beams in the storage room, single-angle diagonals being used across the top of the beams. These beams, four in each of the three 12-ft. bays across the building, are hung by ⅞-in. bolts from transverse 18-in. 60-lb. I-beams carried on rolled H-columns.

The special 25-ton crane carried on independent transverse crane-runway beams across the building is used to transfer the frames on a longitudinal I-beam from the storage end of the building to the furnace. All these panel frames are designed with bolted cast-steel hangers which fit the 2-in. pins in the trolley frames running on the lower flanges of the I-beam runways.

Details of Panel Frames

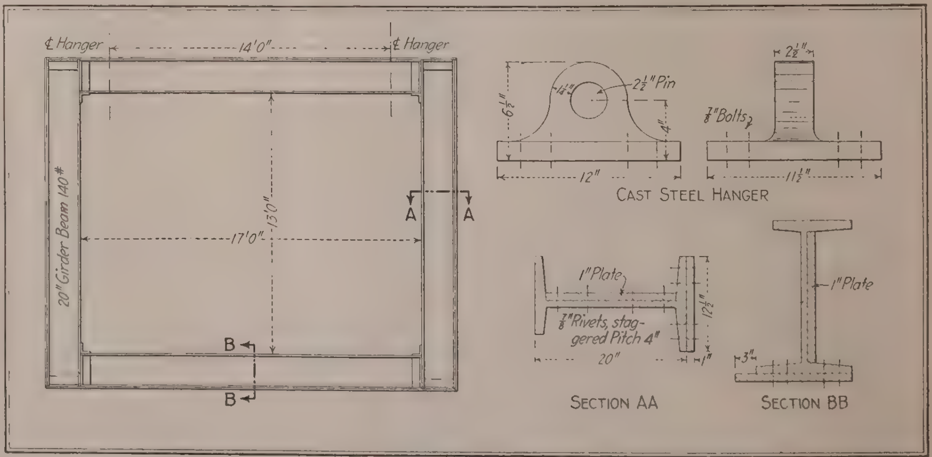
The steel panel frames are 13 x 17 ft., inside dimensions, and will accommodate test panels 12 x 16 ft. up to 12 in. in thickness. The frame used for the heaviest panels consists of four 20-in. 140-lb. girder beams, reinforced by 1-in. plates on the outside flanges and outside of the webs, as indicated in the accompanying drawing. The inside flanges are blocked out to accommodate the construction of the panels to be tested. The 1-in. plates top and bottom are run over the ends of the side girders, and corner connection angles are riveted to them.

The cast-steel hangers, details of which are shown, are offset ½ in. from the center of the frame toward the fire side, tending to make the panel hang close to the furnace face at the bottom. This position of the hangers tends to counteract partly the tendency of the panel to hang away from the furnace face at the bottom after the wall has been built in, since the center of gravity of the built-up panel is nearest the fire side.

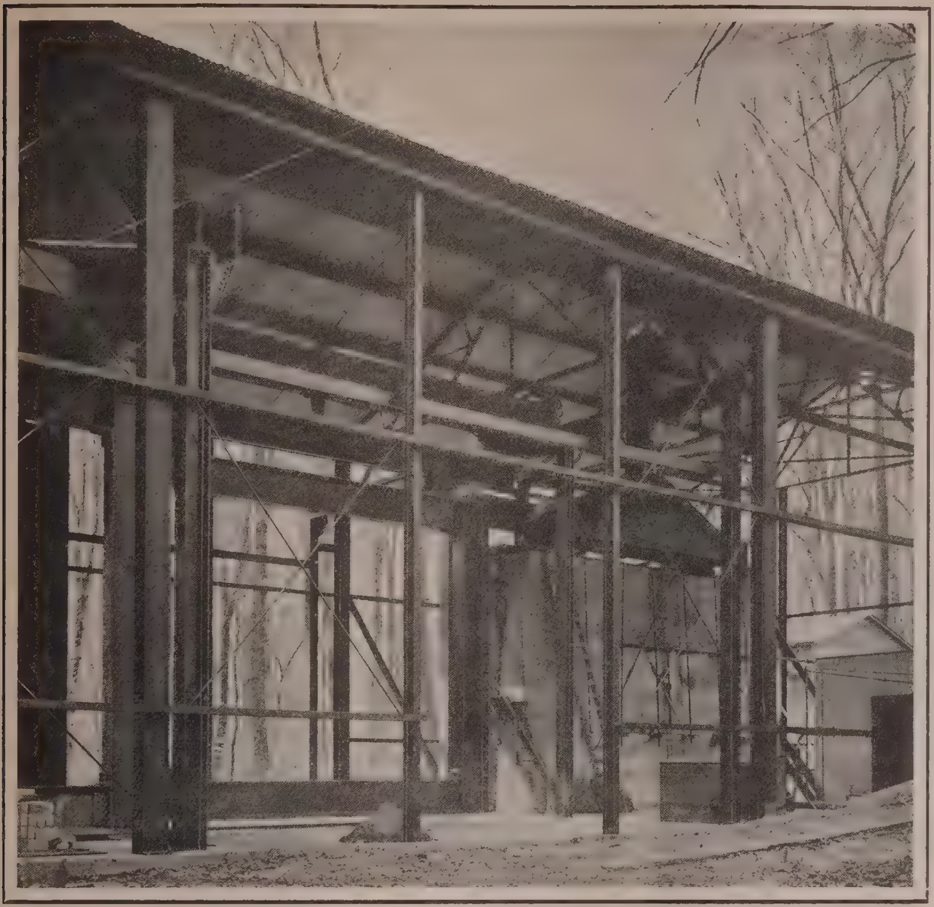
Method of Shifting the Panel Frames in Position for Test

In order that it may be unnecessary to exert great pressure in forcing the panel to fit closely against the face of the furnace, the furnace has been built on a skew, the end nearest the crane being 4 in. and the far end ½ in. off a line parallel to the trolley beam carried by the crane. The trolley beam in front of the furnace consists of a 24-in. 90-lb. I-section suspended by a yoke from a cast-iron roller 8 in. in diameter at the crane end. The other end of this trolley beam rests on small steel rollers on the top of the H-section column.

After the panel has been rolled from the crane upon the trolley beam before the furnace, the roller end of the trolley beam is moved toward the furnace by means of a lever which brings the upper face of the panel in contact with the upper lining of the furnace face throughout its whole length. The lower face of the



DETAILS OF HEAVIEST STEEL FRAME AND CAST-STEEL HANGER



VIEW OF FURNACE ON RIGHT AND CRANE CARRYING STEEL FRAME IN CENTER

panel, which now hangs about 2 in. away from the furnace, is now forced into contact along its full length by a single movement of a large eccentric clamp which is fastened to the floor at the rear of the center of the panel.

After the firing is completed the eccentric clamp is released, the lever which operates the roller end of the trolley beams is reversed, thereby throwing the panel clear of the furnace, and the panel is rapidly pulled out upon the crane by means of a hand winch, where it may be exposed to the fire stream.

CONSTRUCTION OF FURNACE

The back of the furnace, as seen in the photograph, is constructed of reinforced concrete, with at least 18 in. of fire-brick lining. The open face is about 16 x 20 ft. in outside dimensions to receive the test panel frame. Two observation holes are provided at each end to facilitate the inspection of the test panel. The temperature measurements are made by means of seven pyrometers located at points symmetrically distributed over the face of the panel exposed to the fire.

The burner and arched fire-brick combustion chamber are located below the floor level. The furnace is to burn light fuel oil without previous heating. It is guaranteed to develop a temperature of 1700 deg. Fahr. within 30 min. and to furnish a uniform temperature between 1400 and 2400 deg. without varying more than 40 deg. either way from the desired value.

A fire pump and equipment for furnishing a stream of water under 80 lb. pressure through 1⅛-in. nozzles are provided, the test panel being rolled out into the center of the building before this water is applied.

The design of the building and the steel panel frames was made by the engineers of the U. S. Bureau of Standards. The furnace and burners were specially designed for this installation by W. N. Best, consulting engineer, of New York City.

Can Develop Winnipeg Power at Unusually Low Cost

Report of Dominion Water Power Branch Estimates Total Cost at $42.80 and Annual Cost at Less Than $5.50 per Horsepower

DUE in a great measure to the large capacities involved and the geological and topographical features of the power sites selected, the available power in the fall of the Winnipeg River in Manitoba can be developed at 7 sites at an average capital cost of the final output of $42.80 per horsepower and at an annual cost of from $4.50 to $5.50 per horsepower year, according to estimates contained in a report prepared by J. T. Johnston, chief hydraulic engineer of the Dominion Water Power Branch, acting under the direction of J. B. Challies, superintendent of the branch. J. R. Freeman, consulting engineer, of Providence, R. I., and J. B. McRae, consulting engineer, of Ottawa, advised on the organization and scope of the surveys on which the estimates are based. The following notes have been abstracted from a review of the report prepared by T. H. Hogg, assistant hydraulic engineer of the Ontario Hydroelectric Power Commission, Toronto:

The acceptance of a unified power development scheme for the whole river and the establishment of the necessary authority for the supervisory control preparatory to the development of particular sites is the only way in which the full measure of the power resources of the Winnipeg River may be realized. A minimum flow of 20,000 cu. ft. per second is obtainable at all seasons with an efficient and systematic control of the runoff. It is possible to concentrate practically the total fall of the river in Manitoba at 7 power sites.

Estimates of cost for each possible site were prepared in detail. These costs, which were made on a basis of low tension power at the power-house switchboard, indicate that the average capital cost of the total final output of the seven concentrations would be $42.80 per horsepower, based on machinery installed, with an annual cost of from $4.50 to $5.50 per horsepower. The capacity of installed machinery was based on 50 per cent excess over the continuous capacity of the site at 75 per cent overall efficiency. The estimates were carefully prepared and appear to be conservative, the large capacities involved and the geological and topographical features of the power sites being responsible in a large measure for the extremely low costs. No charge was included for the operation of the necessary storage dams of the ultimate developments, and the power rentals to the government were omitted.

STORAGE FOR ULTIMATE DEVELOPMENTS

The necessary storage for the ultimate developments must be secured on the head waters of the river in the Province of Ontario. For that reason some independent government board, such as joint control by the Hydroelectric Power Commission of Ontario and the Dominion Water Branch, must exercise supervision. Independent control will be necessary also for the regulation of local pondage, as control by conflicting and independent interests located at any of the various power sites would jeopardize the efficient operation of the plants below.

At all power sites provision has been made for the future installation of locks, should it be deemed advisable to canalize the river. This provision was made because slack water will exist practically from Lake Winnipeg to the Manitoba-Ontario boundary when the full potentiality of the river has been developed.

LEASES SHOULD BE GENEROUS TO INVESTOR AND PROTECT PUBLIC

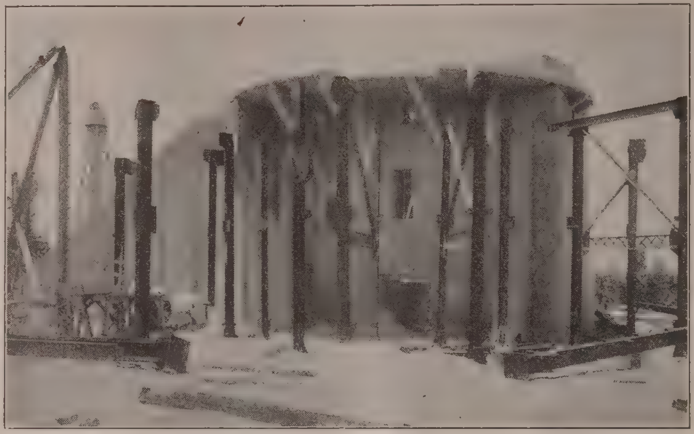
A necessary and vital factor for the success of such a scheme of development is fairness and liberality to the investor without sacrificing the interests of the public in granting the leases. The stated policy of the Dominion Water Power Branch is to encourage desirable development of water power resources, to discourage and prevent the initiation and development of uneconomic and wasteful projects; to insure that the river systems are developed along comprehensive lines wherein each unit is a component part in a system and that adequate storage measures are taken, in the interests of all powers affected; to prevent unnecessary and possible duplication of expenditures on the part of competing plants; to safeguard the public from monopolistic control by regulation and periodical revision of rates; to see to the early carrying into effect of agreements issued by the department for the development of power; to compel the development of existing plants to their limit when the market demands, and to promote in general the fullest conservation of the power resources of the western part of the country.

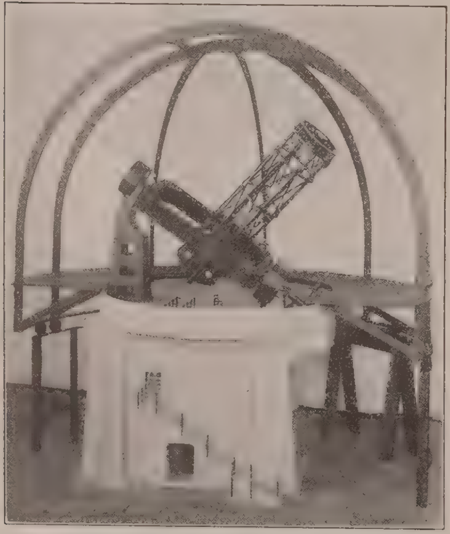
Mountain-Top Foundations Support Huge Telescope

Structure for 100-In. Reflector on Mount Wilson in Southern California Demands Precise Work—Transportation Difficult

ON the summit of Mount Wilson (El. 5889 ft.), near Pasadena, Cal., there is now nearing completion the foundation and steel dome for a 100-in. reflecting telescope to be equipped with the largest mirror ever cast. From the outset great interest has attached to this work from the astronomers' viewpoint, and since the structure has been begun unusual problems of an engineering nature have been presented. Transportation has entered very largely into the enterprise; when the work on other instruments of the observatory was laid out and started in 1904, all equipment and material had to be brought over a rough mountain trail by burros.

The trail leading up the mountain was later replaced by a road which has been improved from time to time and in recent months has been traversed frequently by automobile trucks of capacities up to 6½ tons, which are now conveying the material to the summit. The present road, however, which is 9 miles long, is still extremely crooked and narrow, with grades running as heavy as 20 per cent or more, and sharp curves on the verge of deep gorges.


CONCRETE PEDESTAL WITH STEEL FRAME UNDER CONSTRUCTION


MODEL SHOWING HOW THE GREAT LENS WILL BE MOUNTED

The foundations on which the steel building and dome are erected were made heavy enough to withstand the stresses of a 75-mile wind against the dome which is 100 ft. in diameter and 106 ft. high. The large concrete pier, which is the main element of the telescope foundation, is 33 ft. high and 53 ft. in diameter on top. There are three floors in the pier, and an elevator is provided for handling the 100-in. mirror which will be taken to a lower floor occasionally for resilvering. The second floor is used for water tanks and auxiliary mechanical equipment. At the south end of the pier is an extension which a spectroscope 50 ft. long will be mounted. This extension is covered first with a concrete house and then by a metal structure calculated to keep temperature conditions constant.

The greatest care was used to keep all parts of the pier away from the steel building and its foundations so as to avoid the possibility of vibration which might be transmitted to the instrument through such contact. The earth at the site, which is decomposed granite, was removed from around the foundations and later thrown back loosely as an additional protection against vibration and in order to cushion the structure from even the slightest local disturbance. As no sand was available for mixing the concrete, clear decomposed granite that had passed through the rock crusher was used as a substitute. This gave excellent results, it is stated, the only apparent difference being that it caused a slightly greater shrinkage of the concrete than when ordinary sand was used.

SUPERSTRUCTURE AND EQUIPMENT

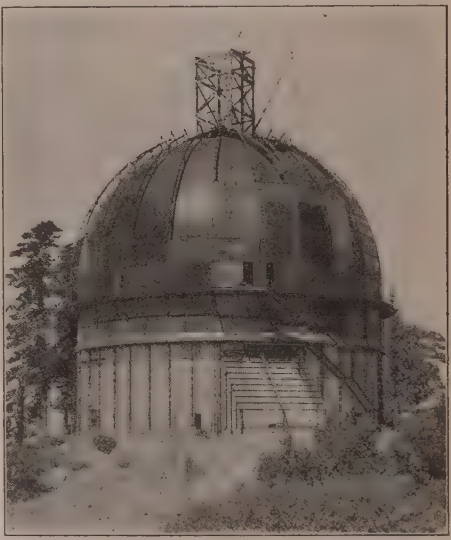
The lower part of the building, up to and including the tracks on which the dome revolves, was erected in 1914. The tracks were placed with great care and to insure a perfect surface on which to rotate the dome, a home-made radial arm supported on a pivot in the center was used to swing a grinding machine around the circular track. With this equipment the track was worked down until an extremely true and smooth surface was secured. In 1915 the steel superstructure of the observatory was completed to a point where it was considered waterproof, and some of the operating mechanism was installed. This included the trucks on opposite sides of the dome and the motors and connections by which it is operated and controlled.

The steel dome has a double wall and roof throughout to insure stable temperature conditions, and the main floor is a part of and revolves with the dome. This floor, however, is separated from the pier walls by a 2-in. clearance. A movable observers' platform, giving access to the instrument in any position, is hung from the dome and a wind shield is installed to shelter the telescope from wind coming through the openings. The opening through which observations are made is 20 ft. wide and is equipped with shutters arranged to roll to one side when the telescope is in use.

The steel for the dome was fabricated in Chicago, where it was erected before shipment to insure exact fit. When re-erected on Mount Wilson no serious difficulty was encountered, although two 8-ton parts had to be lifted bodily into the main arch nearly 100 ft. above the ground. The heavy parts of the telescope mounting, which weighs about 135 tons, were made by the Fore River Ship Building Company in Quincy, Mass., but all of the smaller and more accurate mechanism has been made in the Pasadena instrument shop of the observatory. Four pieces of the tube were too large to be shipped by rail and so had to come by steamer around Cape Horn. Loads of steel weighing as much as 11 tons have been taken up the road to the observatory site by a single 6½-ton Saurer truck.

4½-TON GLASS CASTING

The difficulty in the casting of a 100-in. reflector is that for so great a diameter a thickness of 13 in. was considered necessary in order to prevent bending. This would require a perfect glass casting weighing 4½ tons. A satisfactory casting was finally secured, however, at the plant of the St. Gobain Glass Company of Paris, France. Since the lens arrived at the observatory optical shop several years ago, work on it has been constantly carried on by Mr. Ritchey, and it is expected that the polishing process will be finished early in 1917.


THE DOME IS 100 FEET IN DIAMETER AND 106 FEET HIGH

Dr. George E. Hale is director of the Mount Wilson Observatory and, in addition to the structure now nearing completion, has had charge of the installation and operation of other astronomical equipment in use there. These men directed the work: Francis G. Pease, instrument design; G. W. Ritchey, chief optician; George D. Jones, superintendent of construction of buildings; Clement Jacomini, chief instrument maker, and Alden F. Ayers, foreman of instrument shop.

Suggests Fine Gravel Foundation Course for Concrete Roads

A layer of fine gravel, from 2 to 4 in. in thickness, laid on a thoroughly drained base, was suggested as an ideal foundation course for use under concrete pavements by J. H. Huber, resident engineer of the New York State Highway Commission, at this year's Good Roads Week at Cornell University.

Wide Range of Topics Discussed by Waterworks Men

Abstracts of Some of the Papers Presented at the Thirty-Sixth Annual Convention of the American Waterworks Association in New York City, June 5 to 9

Distributing Reservoirs Demand Careful Location

Where Not Economically Impossible, They Should Be Near Center of Congested Value District to Minimize Friction Loss

By DABNEY H. MAURY
Consulting Engineer, Chicago

WHERE economically possible the distributing reservoir should be located near the congested value district of the city so as to minimize friction losses in the mains. In the construction of a concrete reservoir leakage elimination is difficult, though it is possible with proper materials, mixture and workmanship.

Steps in Taking Water from Source to Consumer

In any waterworks system there are usually a number of steps between taking the water from its original sources and the actual delivery to the consumer. These steps are: The collection and storage of the water of a stream in an impounding reservoir; pumping it from a stream or lake, or from wells to such a reservoir or to a settling basin, filters or directly into the distribution system; purification either by sedimentation or by filtration, or both; pumping from the surface reservoir, the sedimentation basin or from the clear water reservoir of filters into the distribution system; and the actual delivery of the water from the distribution system to the various consumers. The usefulness of any reservoir depends upon and is limited by the position which it occupies in respect to the order or procession of the steps just enumerated. The nearer it is to the beginning of the procession the less will be its value, other things being equal, and the farther along it is the greater its value will be. A distributing reservoir properly located will help out the capacity of the distribution mains themselves, this being a very important function that has been frequently overlooked.

Value of Proper Location

Where small waterworks plants have elevated storage one frequently sees the tank located on the pumping station lot. A tank so located is in most cases a monument to the bad judgment of the man who designs the plant. The capacity of a reservoir should be made as large as the finances of the local water department will permit. In any event, it should be made large enough to tide over the demand of the four or five hours of maximum consumption, and, if possible, its capacity should at least be equal to a full day's pumping. Where the elevation required is high and the capacity small, the reservoir will have an elevated tank supported by a tower, the whole structure usually being of steel. Other things being equal, that type of tank in which the average elevation of the stored water is highest is to be preferred, and when such tanks can be secured, as at present, at relatively low cost, and made in attractive design, it would seem that the old-fashioned tall standpipe, in which three-fourths of the contained water serves no useful purpose except to support the upper one-fourth, has no longer a right to exist.

Construction Difficulties

It is not an easy matter to build a reservoir which shall be absolutely watertight from the time the forms are removed. Fortunately, however, very small leaks will usually become less or "take up" in a short time, especially when the stored water contains iron or sediment, and, in most cases, it is not very difficult to stop large leaks, or at least to reduce them to so small an amount that they will ultimately stop of themselves. In one case a leak was stopped by grooves cut into the line of connection between successive pourings of concrete to a depth of 1½ in. and a width of 1 in. at the surface. These grooves were carefully filled with a mixture of ironite and cement.

It is entirely possible, with proper materials, mixture and workmanship, to prevent moisture from passing through a concrete wall a foot thick, even under fairly heavy pressure. Leaks are most likely to occur in construction joints. The use of steel dams will reduce the danger of such leaks, but these cannot always be relied upon to prevent the leakage, and their presence should not be allowed to diminish in any way the precautions which should always be taken to prevent leakage of the joints.

The surface of concrete which has begun to set should be scratched and roughened, and all rubbish and dirt should be carefully removed with a vacuum cleaner before the next batch of concrete is poured. This will not always present leakage, but it will go far toward doing so.

Filtration Would Reduce Typhoid's Toll by 3000 Lives Annually

Dollar Spent for Pure Water Will Save Many in Vital Capital—City Officials to Blame for Needless Loss

BY GEORGE A. JOHNSON
Consulting Engineer, New York City

IF all the urban population of the United States were supplied with filtered water or water of equal purity the average urban typhoid fever death rate would be 14 per 100,000. A reduction of 67 per cent in the typhoid rate immediately following filtration has been amply demonstrated. The average typhoid fever death rate among the urban population of the United States in 1913 was 20 per 100,000. By reducing this rate to 14, about 3000 lives would be saved annually and 45,000 cases of typhoid fever prevented. This represents an amount in vital capital equal to $22,500,000 annually, or, at 6 per cent, the interest on an investment of $375,000,000.

Of the 50,000,000 people representing the urban population of the United States, 20,000,000 are now supplied with filtered water. To build filtration works having a total daily capacity of 4000 million gallons daily, sufficient to provide pure water for the remaining 30,000,000 people, would not cost $100,000,000. To operate these works and pay all charges, including interest and sinking fund, would not cost more than $12,000,000 per year, or about one-half the present annual cost in vital capital.

Typhoid Preventable

Typhoid fever is an easily preventable disease. Since it cannot be contracted naturally without taking the specific germ into the mouth, to eradicate it involves only the purity of food and drink. Preventive measures are seriously hampered by lack of funds. Annual budgets, with very few exceptions, are made up by officials who sense but dimly the responsibility they shoulder when they cut health department appropriations.

In the United States 20,000,000 people are now being furnished with filtered water at a cost not exceeding $8,000,000, or 40 cents per capita per year. In those cities having filtered supply the water-borne typhoid fever has been practically eliminated, as reliable statistics prove. The results of water purification always show a big balance on the right side of the ledger. For every dollar spent for pure water many lives are saved in the form of vital capital through the prevention of sickness and death. If a community of 19,000 people spends each year 40 cents per capita for filtered water, and thus each year prevents a single death and the attendant cases of illness from typhoid fever it will come out even financially and also increase its self respect. In Pittsburgh, for instance, the adoption of water filtration has saved over 600 lives, 900 cases of typhoid illness and $4,500,000 in vital capital annually.

Typhoid Toll, 20,000

In this country 300,000 persons suffer annually from typhoid fever and 20,000 die of it. Thus in the course of a decade one person in every 33 contracts the disease by taking into the mouth germs discharged in human urine and feces. Of those who recover a substantial number die later from other causes resulting from depleted vitality. Still others never completely recover from the effects and although they may live to old age their usefulness has been materially curtailed.

To give for each human life lost through typhoid fever an average value of $3,600, and for lost wages and medical attendance $200 per case, the present day annual typhoid toll in the United States amounts to $130,000,000. It would seem that the influence of depleted vitality in the case of typhoid convalescents resulting in earlier death from other causes, and depreciation of usefulness through the years of remaining life, should be given some expression of money value, and, if for this, even $75 is allowed for each typhoid convalescent the final result is $150,000,000 as representing in terms of dissipated vital capital the annual typhoid toll paid by citizens of the United States each year.

Pure Water More Important Than Grade-Crossing Elimination

Grade crossings are a menace to life but not nearly so great a menace as a bad water supply. Of all public work the waterworks is by far the most important and should always be given preference in the allotment of money for the city's maintenance. Ever since it became known that bad water was dangerous to health the public has been entitled by sovereign right to receive pure water. Bad water will put out conflagrations as promptly as pure water, but it will also cause wide-spread disease. In the last thirty-odd years the loss in vital capital through typhoid fever alone was over three times the net property loss from fire in the United States.

It is a customary desire that the waterworks department of a community shall be self-supporting, but it is seldom that large sums of money are kept on hand to defray extraordinary expenses in the department. When questions arise as to the adequateness of the supply as regards volume, or more satisfactory distribution, little difficulty is experienced in obtaining the necessary funds to carry out the work, for the comfort and convenience of the public are affected. With improvements in the supply respecting purification it is different. When a city of 100,000 people is confronted with evidence furnished by its own officials and those of the state health department showing that the water supply requires purification, and learns that works to effect this end will cost say $300,000, there follows an energetic sharpening of pencils to ascertain how this is going to affect the tax rate. Many cities have endured an exceptionally high typhoid fever death rate for years and withheld the finance of support necessary for the furtherance of measures of prevention even when it was plain that the public health of the community would be immensely benefited thereby.

Sewage Treatment Does Not Suffice

Sewage treatment in the large community materially reduces the dangerous pollution of water supply but it does not make safe for human consumption the waters of the stream into which the sewage effluent is discharged. Filtration of such waters is the only way to make them entirely safe.

The filtration of the urban water supply would not only reflect upon the general welfare of the city dwellers alone, but would also have its effect on those living in rural communities. This benefit is not measurable in precise figures, but what pure water in one city may mean to the health of a nearby community was never better demonstrated than in the case of Allegheny and Pittsburgh.

Allegheny has only quite recently received pure water from the Aspinwall filter plant, but as soon as filtered water was supplied to Pittsburgh the typhoid fever death rate in Allegheny, for no other apparent reason, began to decrease. For the three year periods before and after filtration of the water supply of Pittsburgh, the average typhoid fever death rates in Allegheny, located just across the river, were 91 and 93 per 100,000 population respectively. This was a reduction of 60 per cent, obviously due to the large number of residents of Allegheny working in Pittsburgh and drinking the pure filtered water of that city.

Various Factors Influence Pumping Plant Efficiency

Tested Efficiency Proves Builder's Guarantee, But Does Not Give True Indication of What Operating Results Will Be

BY J. N. CHESTER

Hydraulic and Mechanical Engineer, Pittsburgh

Assuming that the coal used at pumping plants contains heat represented by 100 per cent, it is known that with the contrivances in use to-day it is impossible to make apparent in work done as represented by the water column delivered with the most efficient machine, more than 20 per cent of the 100 per cent of heat in the coal fired under the boiler, and in many instances the net result does not exceed 5 per cent. In the boiler, efficiencies are not obtained greatly in excess of 70 per cent.

Radiation in Steam Lines

Radiation must take place and some loss due to friction must be incurred in steam lines. Due to the ineffective utilization of the heat delivered at the throttle by the highest grade steam motors or engines in use to-day, which seldom exceeds 20 per cent, the net result of the original 100 per cent assumed in the coal is 15 per cent.

Much may depend upon whether the steam lines are well proportioned, for if too large and the velocity sluggish the condensation will be increased. If too small, a portion of the heat must be lost in friction. If fair, a large amount of useful energy escapes through radiation and in 90 per cent of the steam plants the covering seldom fits the pipe tight, and, in consequence, is but 50 per cent as efficient as though it were continuous over fittings, and provided against air circulating between the covering and the steam pump. A 10 per cent loss of energy between boilers and engines is not an uncommon one, when by proper care in its design and construction it can be kept within 1 per cent.

Loss in Varying Demands and Heads

Another great loss comes from a varying demand and head and consequent load factor of the plant. It is not a matter that either the designing engineer or the operating officials can correct. Metering intensifies it, so that even when brought to the minimum it still remains a large factor, causing inroads on economy.

In 75 per cent of the waterworks plants there exist no high level reservoirs. Consequently the delivery of the pump is governed by the demand on the mains, which varies throughout the twenty-four hours in the ratio of its extremes of about 1 to 3.

In many plants having a capacity less than 10,000,000 gal. daily fire service is rendered by direct pressure, which calls for an increase, when the alarm comes in, of from 20 to sometimes 100 per cent, for all of which the boiler must be kept in constant readiness, thus grossly increasing the fixed thermal losses.

Acceptance Tests No Index to Operating Results

When an engine is tested for acceptance, and to prove the builder's guarantee of efficiency, a standard is too often set up in the purchaser's mind which he hopes to but never in the future realizes for the reasons mentioned previously, and because the boiler is used for other purposes than the pumping engine itself.

There is a tendency on the part of the station or operating engineer to neglect or disregard his means for removing the back pressure from the exhaust side of the low-pressure piston in his engine. The loss due to low vacuum may be roughly reckoned in precipitating engines at 1 per cent for each inch of mercury. Steam turbines require for economical operation a much greater vacuum than 26, and, while the condensing facilities may be nursed at the time of the test to produce the desired results, the greater is the fall when the lower vacuum of everyday work becomes effective. Another of the major elements that tend to reduce plant efficiency is the inadaptability of many of the steam producing, pumping and auxiliary units in use, due often to the exercise of bad judgment, or none at all, in the original selection and installation, which arises mainly from an unwillingness to incur expense for expert advice in the selection of the machinery.

Organisms in St. Paul Water Eliminated by Sulphate

One Part Copper Sulphate in 10,000,000 Parts of Water Effects Practical Elimination—Treatment Effective for Five Weeks

BY PROF. N. L. HUFF

Department of Botany, University of Michigan

Three tests of the effectiveness of copper sulphate treatment for purifying the water supply for St. Paul, Minn., show this method to be effective in eliminating all forms of organisms with the possible exception of Eudorina and Pandorina. The treatment remains effective for about five weeks. At the end of that period the increase in reproduction is remarkably rapid.

Water is supplied to St. Paul from a series of small lakes extending 20 miles north from the city line. Lake Vadnais is nearest to the city and used as a distributing reservoir. Its average depth is 27 ft.; the ordinary capacity is 3,240,000,000 gal. Samples were collected just above the weir where the water enters the conduit to the McCarron pumping station. The number of organisms was determined by the Sedgwick-Rafter method.

The copper sulphate was distributed by putting the crystals in a burlap sack. This was tied to the stern of a boat which was rowed over the lake to obtain uniform distribution. Motorboats were used where depth permitted. Where access with boats was impossible a small pump was used to distribute the copper sulphate solution.

The water was first treated with copper sulphate June 14, 1915, at which time the number of Synedra pulchella per cc. of water was 3420. One part sulphate to 12,000,000 parts of water decreased the number of Synedra to 1116 per cubic centimeter by June 25. The second treatment was given July 12 and one part sulphate was used for 10,000,000 parts of water. This reduced the number of Synedra from 7720 per cc. to less than 100 per cc. in ten days. The Synedra remained inactive until about Aug. 20.

A third treatment with copper sulphate of the same strength as used in July was given Aug. 27. The number of Synedra was reduced to less than 100 per cc. by Sept. 24. Samples were taken from all over of the surface of the lake and down to a depth of 20 ft.

With conditions under which the treatments were made the use of one part of copper sulphate in 12,000,000 parts of water will eliminate Spirogyra, Cyclotella and most of the Cyanophyceae. Treatments with one part copper sulphate in 10,000,000 parts of water will suppress and practically eliminate Chlorophyceare, Diatomaceae, Cyanophyceae and Protozoa. Treatment with the stronger solution remains effective for about five weeks. After that period the growth becomes rapid.

Chlorination Requires Careful Supervision

Investigation of Details Shows Effects of Method of Mixing, Color and Temperature —Aftergrowths and Corrosion Discussed

BY JOSEPH RACE
City Bacteriologist and Chemist, Ottawa, Canada

WHEN chlorination was first introduced for the sterilization of water and sewage all that was required was the addition of the hypochlorite; the process was then supposed to take care of itself. Tests show that greatest efficiency depends upon attention to details.

Hypochlorite solution was added in a sedimentation basin at the entrance of the Ottawa, Canada, water intake July, 1914, by means of a perforated pipe. The mixture was effected as thoroughly as possible without recourse to mechanical methods. During August the bleach liquor was added directly to the suctions of the low-lift pumps, which take water from the sedimentation basin and place it in the intake pipe under a small positive pressure until it reaches the high-lift pumps. Tests showed that the latter method of mixing gives much superior results with a smaller consumption of chlorine.

EFFECT OF COLOR

Experiments showed that color reduces the efficiency of chlorination and necessitates a much larger dose. About 2½ times as much chlorine has been found to be necessary in treating water of color forty for one hour at 63 deg. Fahr. to get the results obtained with water practically free from color. Water at the Montreal intake, free from color, required about 0.3 part per million of available chlorine for satisfactory treatment.

Tests to determine the effect of temperature showed that 10 cc. of water of color forty containing 0.4 part per million of available chlorine retained only two of the original 424 colonies after being subjected to a temperature of 36 deg. Fahr. for twenty-four hours. All colonies were destroyed after twenty-four hours at 70 deg. Fahr. and only three of the original 424 colonies remained when a temperature of 98 deg. Fahr. was maintained for four and one-half hours.

It has been stated that after the preliminary germicidal action has subsided a second phase occurs in which there is an accelerated growth of organism known as aftergrowth. The aftergrowths obtained under usual working conditions vary according to the dosage of chlorine. When it is small few active organisms, in addition to spore bearers, will escape destruction. Others will suffer a reduction of reproductive capacity.

There is a persistent decrease in the number of B. coli organisms as the contact period is increased. The time required for the completion of two cycles comprising the first reduction caused by the chlorine, the increase or aftergrowth and the final reduction due to lack of suitable food material, depends upon various factors of which the dosage and temperature are the most important. With a small dosage the germicidal period is short and the second phase quickly reached; with large doses the second phase is not reached within forty-eight hours.

Low temperatures reduce the velocity of the germicidal action but extend the period over which it is effective. The higher the temperature the quicker are the action and development of the aftergrowth. These statements refer only to the total bacteria as found by development on nutrient agar. The B. coli did not act in this way and persistently diminished in every case.

DETERMINE CARBONIC ACID

Tests were made to determine the free carbonic acid in the raw and treated waters at Ottawa. During a period of excessive turbidity and pollution a heavy dose of chlorine was used and an increase in the free carbonic acid resulted. It was found that there was no increased corrosive action due to that acid. With the usual dosages of chlorine the increased electric conductivity had no practical significance at ordinary temperatures. At temperatures approaching the boiling point of water the percentage increase of conductivity is somewhat greater and possibly of practical importance.

Experiments were made to ascertain whether the B. coli found after chlorination were more resistant to chlorine than the original culture. The colonies surviving after treatment with comparatively large doses were fished into lactose broth and this culture used for a second chlorination. The surviving organisms were again fished and the process repeated several times. No evidence was obtained that the surviving organisms were in any way more resistant to chlorine than the original culture. A number of the colonies surviving several chlorinations were cultivated in lactose broth. All of the cultures produced less acid than the original one and the average was considerably less than the original cultivated under the same conditions, showing that the biochemical activity was diminished.

Water Consumers' Accounts Kept on Cards

Ripon Light & Water Company Keeps All Records in Compact Form—Not One Card Lost in 10 Years

By E. W. HASELTINE
Manager, Ripon Light & Water Company, Ripon, Wis.

TEN years ago the Ripon (Wis.) Light & Water Company adopted the plan of keeping its consumers' accounts on cards. One color is used for each department; white for water, blue for electricity, salmon for gas, and yellow for merchandise and repairs. Two vault omnibuses contain the records, one for the manager and one for the bookkeeper. Cards are kept for consumers' records, meter readings and meter records.

The advantages of the system are: Compactness, ease of handling and cost. With all the necessary information relating to a consumer's installation, the amount of his bills for eight years, the promptness with which he pays, etc., recorded on a 5 x 8-in. card, the settlement of disputes is greatly facilitated. The small cards are much easier to handle, arrange and keep up to date than any kind of bound or loose leaf books. They may be classed, divided and subdivided to any extent desired with a minimum of labor and time. A ledger may be worked on simultaneously by any number by assigning the cards as desired. The cost of a card system is materially less than that of loose leaf ledgers.

On introducing the system it was feared that some cards might be lost. After ten years of operation, during which thousands of cards have been handled, this fear has been proved groundless, as not one card has been lost.

Railroad Saves $34,674 a Year on City Water Bill

Illinois Central by Water-Waste Campaign Effects Big Economy, Principally in Eliminating Wastes Above Ground

BY C. R. KNOWLES
Superintendent, Water Department, Illinois Central Railroad

RAILROADS are among the largest users of water in the country, consuming daily approximately 1,950,000,000 gal., at a daily expense of over $100,000. It is safe to say that 15 per cent of all the water used by railroads is waste—that is, water drawn in quantities in excess of the amount actually required. The Illinois Central Railroad, by means of a water waste campaign, reduced the expense for city water alone from $225,112 in one year to $190,438. This represents only about 40 per cent of the total cost for water, 60 per cent being for that pumped by company forces. Consequently, there has been effected a greater reduction in the waste, which cannot be estimated in figures.

KINDS OF RAILROAD WASTE

Large quantities are wasted in taking water at tanks and penstocks unless care is exercised to properly spot the engine and avoid overflowing the tender. A conservative estimate of the total cost of this waste per year is $60 per tank. The constantly flowing pipes on bubbling drinking fountains will waste from $150 to $350 per year for each fountain. The only satisfactory way to control this waste is to restrict the size of the opening and to equip all fixtures of this type with self-closing valves.

Yard hydrants for sprinkling, filling water jugs and coach yard service also cause a heavy waste. A 1-in. hydrant of this type will waste from 20 to 30 cents worth of water per hour or $5 to $7 per day. Forty or fifty of these hydrants are often installed in a single coach yard, and, as there are nearly always a number of them open and running, the loss is enormous.

WASTE IN IMPROPER USE OF HOSE

The improper use of hose in sprinkling, washing coaches, etc., causes a great waste of water that may easily be avoided. All hose should be equipped with a nozzle so that the stream will do the maximum amount of work with the minimum waste of water.

Leaking or improperly adjusted valves in toilet tanks will waste from $3 to $50 per month for each battery, depending on the number of fixtures and the cost of water. A case was discovered recently where the toilet facilities at a large terminal were costing a loss of over $400 per month. Wash basins, slop sinks and other fixtures connected directly to sewers and drains offer opportunities for heavy water losses and a saving can be made in almost every instance by giving attention to the valves and faucets; keeping them in proper repair and making it a point to see that they are closed when they are not in use. A dripping faucet may represent a loss of over 50 cents per year, while one leaking through a ½-in. opening will waste water to a value of almost $2,000.

Columbus Waterworks Will Reclaim Its Spent Lime

Tests Indicate That Lime Can Be Recovered from Settling Basin Sludge at Yearly Saving of $9000

BY CHARLES P. HOOVER
Chemist, Filtration Plant, Columbus, Ohio

By building a plant costing $30,000 to reclaim water soluble calcium oxide lime from the sludge in the settling basins at its filtration plant, the waterworks department of Columbus, Ohio, basing its conclusions on experiments conducted on a small kiln, estimates that a saving of $9,000 per year will be realized in the cost of lime alone. The settling basin precipitate will be pumped into a thickener, and from there will be fed directly into a rotary kiln, where it will be burned into lime.

In experiments carried on during the past few months 5000 lb. of lime was produced from a kiln 20 ft. long and 34 in. in diameter, and was used as a softening agent for the entire water-softening plant for a period of 4 hr., during which time 4,000,000 gal. of water were treated. The results of the test indicated that it was possible to obtain just as good results from the reclaimed lime as with the high calcium lime which is ordinarily used.

Lime and Soda Ash Used

Lime and soda ash are used at the present time to soften the entire water supply of the city, which will average about 20,000,000 gal. per day. Approximately 76 per cent of the lime which is added to the local water absorbs carbon dioxide and is thus converted into lime carbonate, and the soda ash, combining with the sulphate of calcium, also forms lime carbonate, which is practically an insoluble and precipitable compound. The average quantity of lime added to the water for absorbing carbon dioxide is 7.3 grains per gallon and the average quantity of soda ash is 7.3 grains per gallon. Every grain of lime which is added to the water precipitates 3.57 grains of lime carbonate and every grain of soda ash added to the water produces 0.93 grain of lime carbonate.

During the year 1914, 3540 tons of lime were used for absorbing carbon dioxide and 3540 tons of soda ash were used. The addition of the chemicals resulted in the precipitation of 15,930 tons of lime carbonate, which if dried, burned and replaced would produce theoretically 8921 tons of lime.

It has been the practice at the plant to settle the lime carbonate in concrete settling basins and to wash the precipitates into the river below the pumping station intake. This results in trouble between the city and property holders below during the periods of low water in the river. During the winter and spring months, when the water from the river is high, there is no objection to turning the sludge into it. The water shows the maximum degree of hardness in the summer, and consequently the maximum quantity of lime carbonate sludge is produced then.

Theoretically it is possible to produce from the sludge a lime containing 79.48 per cent of calcium oxide. During the winter and fall months, when the river water is muddy, the sludge is so contaminated with mud that there appears to be no economical method for reclamation.

Thickener for Sludge

In the plant at Columbus the settling basin precipitates are to be pumped into a thickener, such as the Dorr thickener, and from the thickener the material will be fed directly into a rotary kiln, where it will be burned in the lime. The plan may be changed somewhat in the final design, and the material, after passing through the thickener, may be filtered by means of a suction filter of the continuous type and then fed into the kiln and burned.

During large-scale tests with the reclaimed lime forty-two samples of water were collected, fifteen of which were taken at different points in the plant for a period of 3 hr. previous to the time the reclaimed lime was used. Twenty samples were taken during the time the reclaimed lime was being used and fifteen were taken after the use of the reclaimed lime had been stopped. Results of these tests indicated very clearly that it is possible to obtain just as good results from the reclaimed lime as with the high calcium lime which is ordinarily used. The analyses show that the reclaimed lime contains from 63 to 73 per cent of water soluble calcium oxide, whereas the lime which is ordinarily purchased for water-softening purposes contains 88 per cent calcium oxide.

Estimates of Cost

It is estimated that 25,000 tons will be produced from lime sludge at a saving of $1.65 per ton and 3000 tons will be produced from local limestone, for which the kilns will also be adapted, at a saving of $1.69 per ton. The estimated saving total will be approximately $9,000 per year. The cost of the plant will be about $30,000.

Centrifugal Pump Increases Efficiency of Plant

Motor-Driven Unit Adapts Itself to Load Conditions and Permits of One Boiler Being Cut Out for Part of Each Day

BY S. R. BLAKEMAN
Superintendent, Dyersburg Water & Light Company

The water and light plant owned and operated by the city of Dyersburg, Tenn., is located on the banks of the Forked Deer River. As the turbidity of the stream is extremely high the water supply is pumped from deep wells, treated and filtered.

The original design included two compound steam pumps. One lifted water from the wells to the treating tank; the other delivered water into the mains against a pressure of 80 lb. per square inch. Later, another steam pump of 1,000,000 gal. per day capacity was added. About the same time two new engines and generators having an aggregate capacity of 435 kw. replaced the smaller original units. This equipment necessitated operating the plant for long periods on loads below half the rated capacity.

Conditions Improved

To eliminate this undesirable condition additional load was necessary. It was obtained from an outside source and by installing motor-driven pumps in the plant. The load curves made from data collected after the motor-driven pump had been put in operation show a marked improvement over conditions as they were previously. The last steam pump has now been replaced by a motor-driven triplex boiler-feed pump.

The most careful comparisons were made to determine the kind of pump best suited to conditions. All requirements and conditions were carefully surveyed before the pump was purchased. The location is at a point where the suction lift is a minimum. Extensive tests show that the guaranteed efficiency has been exceeded. Data for four running days in October, 1915, show that a steam pump operating for two days necessitated using 2.93 tons of coal more than was required for the centrifugal pump. The same amount of water was pumped in 48 hr. by each kind of pump. One boiler has been cut out for a great part of the day since the new installation.

Try Surface Oiling to Improve Old Gravel Road

Novaculite, or hill gravel, has been used to build a number of roads in and about Cairo, Ill. It is mined extensively from hills near Tamms, Ill., and is found to be an excellent bonding material which packs readily without rolling, but washes badly in the early spring and wet seasons.

Owing to heavy traffic on the roads in question it was necessary to resurface them about every third year, so the district road commissioners decided to oil the surface. At the advice of the state highway department they ordered one tank of Mexican asphaltic oil, containing from 60 to 65 per cent asphalt, and applied it to the surface.

ITEMIZED COST OF WORK

	Cost, cents per sq yd
*Superintendence, engineering and inspection	0.21
Bituminous material, 8184 gal. at 4.7 cents f.o.b. siding	2.34
Torpedo gravel and stone chips, 66½ cu. yd. at 59 cents f.o.b. siding	0.24
Heating and applying bituminous material, demurrage, etc.	0.32
Spreading torpedo gravel and stone chips, sand	0.31
Sweeping and cleaning old road	0.034
Depreciation on equipment	*
Freight on equipment	0.54
Total cost	3.99

*Paid or furnished by state highway department.

The oil was put on cold and within twelve hours after the application a light dressing of river sand was applied and the road opened to traffic.

The cost data in the accompanying table recorded by Theodore Plack, engineer in charge for the state highway department, do not include contractor's profit or overhead expenses. The 8200 ft. of 18-ft. macadam road was treated with ½ gal. of Aztec liquid asphalt and 0.006 ton of torpedo gravel or stone chips and sand per square yard. The average haul of materials was ½ mile. The rate of pay was 15 cents per hour for labor and 40 cents per hour for teams.

Steel Truss Spans Raised More Than 6 Feet Without Interruption to Traffic

Pennsylvania Railroad Forces Successfully Design and Apply Simple Lifting Device to Bridge at Kiskiminetas Junction, Pennsylvania

WITHOUT detaining a single passenger train, and with a maximum delay of only 5 min. for freight trains, the three steel spans over the Kiskiminetas River at Kiskiminetas Junction, Pa., on the main line of the Allegheny division of the Pennsylvania Railroad, carrying a heavy traffic between Pittsburgh, Oil City and Buffalo, were raised an average height of more than 6 ft. This was accomplished by using an expeditious and economical method finally adopted after considering various schemes. This method utilized four 50-ton screw jacks with six sets of jacking beams to form lifting devices connected by eyebars to the end pins of the truss spans. Thus the work could be prosecuted from the bridge seats without the use of falsework other than the blocking on the piers and the abutments. After the spans were raised in successive lifts of about 16 in. each across the structure, the tops of the piers and the abutments were poured with concrete to form the new bridge seats.

GENERAL REQUIREMENTS

A revision of the facilities at Kiskiminetas Junction, where the Allegheny and Conemaugh divisions of the Pennsylvania Railroad intersect, involved a change in grade requiring the raising of the three-span bridge of the Allegheny division over the river by 5½ ft. at one end and 7 ft. at the other. The bridge is a single-track structure over which a heavy through freight and passenger traffic is gauntleted. The spans are of the pin-connected through-truss type, about 240 ft. long, carried on masonry abutments and piers with the base of rail about 45 ft. above the water.

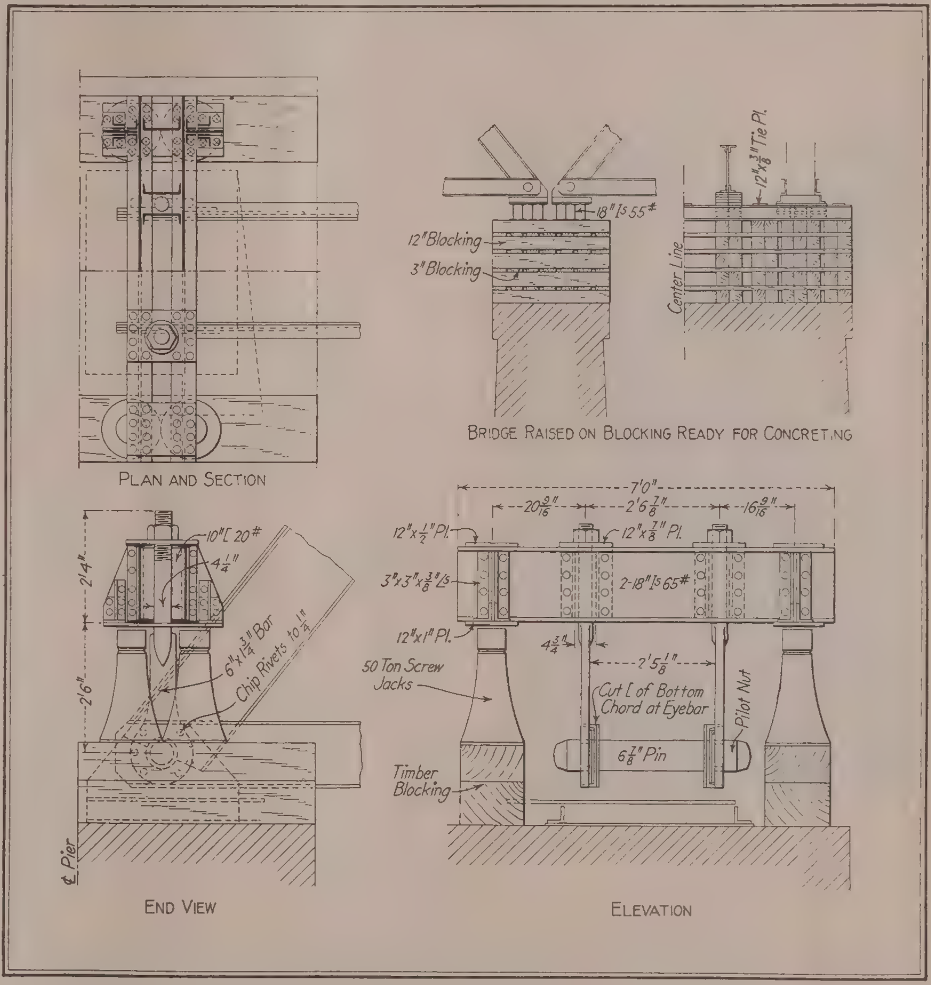
The U-shaped abutments had sufficient width to allow side walls of concrete to be carried up without obstructing traffic. The walls supporting the fill for the ballasted roadway could not be carried up complete until after the bridge was raised. To provide for this fill about 3 ft. of these walls were constructed, forming an "L" with the side walls, against which 12 x 12-in. timbers were placed as a temporary back wall. These timbers acted as the form when the concrete was cast for the back wall, after the span was raised.

JACKING BEAMS USED

To accomplish the work of lifting the spans six jacking beams, each consisting of two 18-in. I-beams with two adjustable eyebars, as shown in the accompanying drawing, were designed for use with four 50-ton ratchet screw jacks. This furnished ample capacity for emergencies, as it was calculated that each end shoe carried only about 190,000 lb. dead load. One jacking beam was placed over each shoe on an abutment, and kept there until necessary to move to the other end of the bridge, and the other four beams were moved back and forth from pier to pier as required.

Fortunately the end pins in the trusses had sufficient projection to allow the use of the 6 x 1¾-in. eyebar hangers shown, by removing the pin nuts and replacing them by pilot nuts over which the eyebars could be slipped.

The work of raising was begun at one end and carried up on the initial lift to a height of 16 in. To avoid excessive grades on the spans the end of each span resting on the next pier was carried up 16 in., and the work thus progressed back and forth until the required height was reached. The blocking consisted mainly of 12 x 12-in. oak timbers equal in length to the width of the abutment bridge seats, or of the piers. These blocks, supporting the spans under train load and the jacks during the operation of raising, were laid parallel to the bridge axis, alternating with 3 x 12-in. planks at right angles to tie them together.



FOUR 50-TON JACKS LIFT JACKING BEAMS CONNECTED TO END PINS BY EYEBARS

As the bridge was raised wooden wedges were inserted under the shoe and kept driven tight as the work progressed. When the shoe was high enough these wedges were replaced by 3 x 12-in. plank, three in width under each shoe, 4 ft. long parallel to the bridge axis. Following this method to a height of 16 in., one width of plank blocking was removed from under each shoe and replaced with a 12 x 12-in. timber, the load being carried on the other two widths during this change. Three-inch planks and wedges were then used to take the load on the 12 x 12-in. blocking just inserted, and the next pile of 3 x 12-in. planks was replaced by the heavier blocking.

This method was followed under bridge shoes and stringer bearings until a course of 12 x 12-in. timbers extended the full length of the pier or abutment. When the bridge was raised to within 18 in. of its final position four piles of 3 x 12-in. planks, 4 ft. long, were laid under each shoe at right angles to the bridge axis, with a like arrangement under the stringer bearings. This permitted the easy installation of four 18-in. I-beams running the entire length of the pier (25 ft.) under the end of each span as shown. These beams were inserted to replace one pile of blocking at a time, and after all were in place were securely tied together by batten plates.

This I-beam grillage on top of the blocking was provided to carry the dead and live loads of the structure while the wooden blocking was being replaced with the permanent concrete of the pier. This system permitted the quick resumption of traffic by the reversing of the jacks and the settling of the structure on the wedges and blocking.

REPLACING BLOCKING WITH CONCRETE

By sawing through the 3 x 12-in. ties laid at right angles to the 12 x 12-in. blocking it was possible to remove all of the latter from under the I-beams immediately below the shoes, the space being bridged and the load carried on the beams. A block of concrete 4 ft. wide extending the full width of the pier was poured, with the top flush with the top of the beams. This arrangement was carried out on one pair of shoes on the pier at a time, and likewise for each shoe on the abutment until the trusses were carried on permanent bearings. The wooden blocking under the ends of the beams and between the concrete blocks could then be removed.

The stringer load was supported by the beam grillage reinforced with one 12 x 12-in. post under the end of each stringer. Round iron was inserted in the concrete blocks under the shoes and permitted to project to act as a tie for the concrete closures, which were then poured. The piers were thus extended to the new height and finished with the concrete-incased I-beam grillage for the bridge seat.

The raising operations were carried on in daylight at such intervals as the scheduled train service permitted, and required thirteen days. The structure was carried up true to line except at the north abutment, where a lateral movement of 2 in. occurred, which was easily brought back to its proper line by the use of jacks. There was no longitudinal movement in any of the trusses.

BRIDGE AT INTERMEDIATE PIER RAISED NEARLY TO FINAL HEIGHT

The work was carried out by the railroad company's forces entirely, under the immediate supervision of E. W. Holmes, master carpenter.

Meter Repair in Milwaukee Decreased in 1915

Meter repairs in Milwaukee during 1915 showed a decrease of about 3½ per cent as compared with the record of the three previous years. This result, according to the annual report of H. P. Bohmann, superintendent of waterworks, is accounted for by the fact that the distribution system was flushed during the year 1914. The number of meters taken off on account of sand trouble since flushing the distribution system has been greatly reduced. Last year 14,283 meters or 22.9 per cent of all meters in service were examined and repaired. On Dec. 31, 1915 there were in actual service in Milwaukee 52,188 water meters.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Statement from Secretary Lane

SIR: My attention has been directed to an editorial in the Engineering Record of May 27, 1916, wherein, referring to the "Shields bill," you state that "Secretary Lane has indorsed the measure." This is an error, as I have not indorsed the bill in question, nor have I had occasion to express an official opinion thereon, because it deals with navigable waters, which are under the jurisdiction of the Secretary of War.

The water-power bill upon which I submitted a favorable report is known as the "Ferris bill," H. R. 408, and relates to development of water power upon the public lands.

FRANKLIN K. LANE,
Secretary of the Interior.
Washington.

Cost of Railroad Surveys

Sir: The Engineering Record of March 4 has just been received and it is particularly gratifying to note that, on page 316, you have published a most timely article on the cost of surveys and engineering for railway work. There have in times past been numerous fallacies accepted by railway men in general and unfortunately at times by members of engineering departments who should know better. One of these has undoubtedly been the adage that "surveys cost about $100 per mile, ranging from $50 in easy prairie country to $150 in timbered or mountainous regions." There is no doubt in the mind of the writer that the general acceptance of this figure has tended greatly to bring competent engineers into disrepute. When men of recognized standing in the profession persistently repeat this figure it is not to be wondered at that promoters and administrative officials should take their word for it, and then find to their cost and deep regret that either the line secured was not obtained for any such figure, or if it was, that it undoubtedly differed greatly from the best the country could produce.

The writer has been an engineer on surveys and construction of railways and other works for a good many years, in the mountains, plains and swamps of a half dozen different countries, and he has personally never known of a case where a final location was obtained for $100 per mile, or anything like that figure, unless the cost of all previous surveys and equipment, transportation and reconnaissance be disregarded.

At the present time investors and bankers of the United States are devoting a great deal of attention to the undeveloped territory to the south of our country, and the development of the new fields will undoubtedly be accompanied by the construction of railways. A great deal of this work will undoubtedly be handled by American engineers, and it is to be earnestly hoped that a sensible estimate, such as was prepared by Mr. Sparrow, of the Missouri Public Service Commission (see the Engineering Record of March 18, page 386) will be seriously borne in mind.

It is doubtful if a survey can be made anywhere in South or Central America, and the plans prepared for staking out the work and instructing the contractors as to what they will be expected to do, under $500 a mile. If an exception be taken to this it would be that the plains of the Argentine and the plateau of Northern Mexico should not be included in this general statement, as they can be easily covered by the parties in the field, and there is a relatively small number of special structures, which would undoubtedly reduce the cost considerably. This estimate of $500 per mile does not include general work on construction, nor especial designs for large bridges, nor unusual buildings, nor any work on equipment and machinery, nor final records, but only the total cost from the beginning of reconnaissance until the contractors receive all the documents required for them to prosecute the work.

Cases have been known where the cost per mile was as low as $400, with the exception of overhead or administrative charges outside the engineering department, and cases have been known where the cost was $600 per mile in very bad territory, but it would seem that the preliminary estimates which are generally high enough to cover unexpected charges and which in the case of doing work in South America would include salaries and transportation expenses to get men to work, should not be less than $500 per mile of finished road. This does not refer to the cost of running one preliminary, but involves the cost of covering the ground two or three times before the final line is selected and located.

V. L. HAVENS,
M. Am. Soc. C. E., American Commercial Attaché.
Santiago, Chile.

Prospective Development and the Value of a Railroad

SIR: I have read with considerable interest your editorial criticism of my suggested method of determining the economical value of any railroad and am led to fear that I could not have made myself as clear as I had hoped.

To me it seems that there are certain fundamental propositions respecting the railroads of the United States which are so apparent that to be proved they need but to be stated—to wit:

1. The existing railroads were constructed with private capital under the uncontroverted conviction that the property created was privately owned and entitled to the same protection as that accorded all other property.

2. The public, in permitting and encouraging, even urging, the investments without in any way indicating a future discrimination, acquired obligations to the railroads in no degree less than those assumed by the railroads toward the public.

3. The present economical position of the railroads is not that of private enterprise, but the property has in essence been condemned for public use; and the absorbing problem at this time is the equitable deter-

mination of the compensation due the nominal owners. The present policy appears to be regulation of earnings and operation of sequestrated property rather than liquidation of the value itself; and under such a policy those whose capital is forced to serve the public on that public's own terms are certainly justified in asking that the terms be liberal enough to meet at least the *minimum* requirements of private operation.

The final finding of value by the Interstate Commerce Commission may be used for a number of nominal purposes, all revolving around the central fact of governmental administration. It may even be used as a basis for governmental acquisition of title. It is extremely doubtful that it will ever be used as a positive factor in the construction of rates; but may serve, as previous valuations have done, as a signal warning of the approach to limits beyond which the court says "No." This is the only rate-making function which any valuation can have, as rates must of necessity be based, at least partly, on the abilities of commodities to pay, whether the rates are constructed by the railroads or by other agencies.

Now, to answer, as well as I can, your criticisms. There is nothing revolutionary in the proposition to base present worth on future prospects, even in a railroad valuation. One of the so-called intangible values frequently mentioned is "strategic position," which gives to one road control of a rich and developing source of traffic; another is location with respect to topography and traffic, which gives one road an advantage in the ability to expand with the least expenditure of capital as demands require, and to secure an increasing share of the traffic. The principle is one generally recognized by investors in securities of all kinds and has its influence on their market quotations. It was used by the owners of certain Prussian railroads in the conferences with government representatives to effect higher compensation for their roads when they were taken by the state, and produced the desired result (see Bulletin 21, Bureau of the Census, page 68). It is a consideration of all engineers in making recommendations for expenditures.

Briefly, I do not conceive that I have propounded a new theory, but have merely given concrete expression to a generally acknowledged economical principle.

In the application to individual roads of the proposed measure of value it appears to me that in equity consideration must be given the economical conditions obtaining at the time of construction and those now prevailing, and to the causes of their change, if changed. Should it develop that under a continuation of natural conditions the road could not have been profitable, then the trend of actual earnings should be studied and followed regardless of where it led, as revealing what we are all seeking—the truth; but it should be borne in mind that unless restrained the owner could have suspended operations. If he is compelled to operate, then the total cost of service, including interest on his forced sacrifice, and also a profit for conducting the operation become public obligations. Further, should economic conditions have been artificially changed purposely to affect his property he is in equity and under the constitutional guaranty entitled to ask that the limit of depression be set at that point below which his operations cease to be profitable.

This, then, is my proposition: That the value so far as possible be determined on the same economic principles as would govern the free purchase or sale of the property; that the minimum value that can be assigned any railroad which, if free from artificial restraint would equal or exceed that amount, is the present worth based on continued profitable operation, and that the regulating agencies be restrained from *depressing* earnings *below* those required for operation at a profit.

R. B. SHEPARD, JR.,
Office Engineer, Valuation Department, Atlantic Coast Line Railroad.
Wilmington, N. C.

Present-Day College Education

SIR: The discussion between Professors Mead and Swain on college education which has recently appeared in the Engineering Record leads me to write you in reference to the operation of the co-operative engineering course inaugurated by Dean Herman Schneider at the University of Cincinnati.

Our firm has been employing co-operative students for a number of years and the writer has talked to a number of other employers in Cincinnati who use co-operative students, and all with whom I have talked agree that this is an excellent form of education. The course normally takes five years to complete, but we have in our employ at the present time a student who completed the course in four years, the first three years of which he took the co-operative work and the last year he spent entirely at the university.

This method of education enables an ambitious boy who could not otherwise obtain a college education to do so through his own efforts. Our company generally pays the first-year students about 20 cents an hour and, as they work ten hours a day, this would equal $12 per week. The students who have worked for us more than a year get regular laborer's wages, which for the last year have been 25 cents per hour—thus netting the boys about $15 a week, and from now on the wages will be even higher than this.

All the superintendents on our work prefer having these college students to any of their other laborers. The students do all kinds of work and do it more intelligently than our other workers. Sometimes we use them for timekeepers, but this is avoided, as it is found that the change from one student to another is not entirely satisfactory in this instance. However, even in a position of this kind we have found we could work them to advantage. In addition to the straight labor work which they do, such as helping concrete, placing reinforcing steel, etc., they also have experience in direct engineering work such as laying out the lines for buildings, checking subcontractors' work, making drawings, estimating the amount of work completed and assisting our superintendents and foremen in numerous ways. Of course it is probable that a relatively larger majority of good material take this course than is the case in the ordinary college or technical school.

Undoubtedly a great many men go to college simply because they think it is the thing to do, this being particularly the case with the sons of rich men. There are less of this class of students who take the co-operative course and more of the earnest workers who strive to get the utmost out of their education.

The boys in this co-operative course usually are employed during their entire summer months with the same employers, and they are practically assured of a job when their course is over, as their employers are glad to keep them. Also, after graduation, I believe they are assured of a better position than they would otherwise be able to obtain, on account of the practical knowledge they have gained during this course.

No boy going through college gets the most out of his opportunities. This is due partly to his not realizing the advantages he can gain and to his desire to have fun, and also to the fact that he does not realize how some of his studies will be applied in later life or their relative importance. I believe that the co-operative course helps to a certain extent to make a student realize how he is to apply some of his studies, and that his contact with actual workers tends to cause him to take advantage of his opportunities. Some of our superintendents are men who have worked their way up without college educations, but they invariably wish that they had had the chance to take a co-operative course, and undoubtedly so express themselves to the co-operative students.

Some of my associates feel that the principal advantage of this form of education is the fact that the earning power of the boy enables him to get through college, and that if his means allowed it he would get as good an education by continuous school work with possibly some work in the summer time for which he received pay, but I personally believe that, provided the college facilities and teachers are the same, a boy gains in co-operative work more than he would in a straight school course on account of the actual experience which he gets while he is doing his college work.

W. P. ANDERSON,
President, The Ferro Concrete Construction Company.
Cincinnati.

SIR: The letter written by Professor Swain and the reply by Professor Mead were read with great interest. They started something, set forth some startling facts —facts that may be new to the engin neer, but, from the quotations cited, evidently not to the educator and philosopher. These men have been confronted with the problem for years; yet have been unable so to line the forces as to close the polygon. On the face of it it seems to be purely a pedagogical problem, one to be dealt with in the pedagogical journals and not on the pages of an engineering journal, however vital it may be to the development of the future engineer.

When we say that "it is possible to graduate from almost any college without an idea in one's head" are we to place the blame on the college and without further thought let it rest there? The college is not to blame. The student has been forced to spend twelve of the most impressionable years of his life in some elementary school before the doors of any college will be swung open to him.

Are our elementary schools what they should be? I shall not try to answer that here. But it is safe to presume that they are not. If they are not what are we who, through our experiences, are aware that something is wrong doing to aid in eradicating the wrong? There are educators by the score in our elementary schools that are alert to the evil of their methods; but they are only hirelings, and if they are forced to save the chaff and throw away the wheat it is no fault of theirs. They are your servants and mine. We have delegated the direction of their services to the school boards of the country, without giving a serious thought as to the personnel of the individuals who may compose these boards.

Are there any engineers on our school boards? The percentage is undoubtedly very low. These groups of individuals into whose hands we give the power of directing how the youth of the nation shall be educated are made up of politicians and those who seek the position for the social prestige that it may give them. As a result the trend of our elementary school training is toward the superficial, and the young mind that otherwise might be capable of close, concentrated and logical thinking is turned over to our colleges possessed of nothing but a veneer, made up of a conglomerate of polishes.

Is it any wonder, then, that the products of our colleges are as some one has put it, mere animated handbooks with a slide-rule attachment? Is it any wonder that the greater percentage of young men who do enter college choose such courses as will not mar the polish acquired in the elementary schools?

What are we going to do about it? Are we as engineers going to do as we and others have done before, let it go by default? Or are we going to cast our eyes about us and find some conscientious, struggling instructor in our elementary schools who is eager for support and help him? The writer can think of no more worthy field for the various engineering clubs and societies of this broad land, in which to exert their efforts and make their presence felt in the communities in which they may exist, than to give some attention to the personnel of the elementary school boards of their community, and thus purge our lesser temples of learning and make them worthy of the name.

Cincinnati. HARRY C. REELY.

High Velocity in Large Hydraulic Dredges

SIR: Major Dent's letter in the Engineering Record of May 27, 1916, page 714, has attracted my attention. Small sizes of discharge pipe are advisable on account of the constant handling of the lengths of pipe on shore. The only objection to large floating or pontoon pipe is the cost, both initial and operating.

The loss of the efficiency of the large pump working under high heads, due to length of pipe as well as diameter, should rather be stated as the loss in efficiency of the carrying power of the stream in the pipe. The longer the pipe the greater the length of time for the settling of the heavier material at the bottom of the pipe. It is a fact that the longer the discharge pipe the smaller is the percentage of solids pumped. The reason is that the solid material drops to the bottom of the pipe and moves more slowly than the water stream, the separation, and consequent difference in velocity of water and sand being more pronounced for longer pipes. High velocities mean less time for separation and a larger percentage of solids.

It is perfectly conceivable that the extra horsepower required for the higher velocity will result in an equal increase in percentage of solids pumped. If so there is no increase in operating expense, but there is a real gain when considering overhead charges.

An increasing use of electric motors for driving the centrifugal pumps on dredges would naturally influence dredge pump designers toward smaller diameter of impeller and higher speeds, having regard for the largest size of stones to be pumped. The writer calls to mind an episode bearing on the relative size of pump and stones pumped. A contracting company was using a 20-in. pump for transporting purposes only, the dredged material being deposited in a specially designed hopper by a dipper dredge. The material then passed through the interior of a revolving screen with holes 7½ in. square. Thus the screen rejected all stones more than 7½ in. in diameter, the pump handling all the rest. The holes in the screen were later changed to 10 in. and used for some time, but a return was finally made to the 7½-in. hole, although this meant a larger percentage of rejections to be handled in a much more expensive way than by pumping.

G. B. MASSEY,
Chicago. Consulting Engineer.

Heavy Rainfall at New Orleans

SIR: In your issue of June 3 you mention that nearly 8,000,000 tons of rain fell over Rochester during 23 days last month—a rainfall of 4.2 inches over an area of 16,000 acres.

The drained section of New Orleans covers an area of about 25,000 acres, and on May 21 and 22 we had a rainfall of 6.74 in. average for the entire city, with a high record of 8.11 in. at one of our central gages. The rain started at about 9.30 a. m. May 21 and stopped at 2.30 p. m. May 22. During this period of only 29 hr. there were three distinct showers of approximately equal intensity with a total precipitation of 6.74 in., or 611,655,000 cu. ft., weighing more than 19,000,000 tons. Our partly completed drainage system handled this near record rainfall very satisfactorily.

Our records of very severe storms show the following:

April 25, 1907	8.59 in. in 12 hr.
Sept. 29, 1915	8.36 in. in 21 hr.
Oct. 12-13, 1915	7.96 in. in 21¾ hr.
May 21-22, 1916	6.74 in. in 29 hr.

ALF. F. THEARD,
New Orleans. Civil Engineer.

Architect vs. Engineer

SIR: I read your editorial appearing in the issue of March 25, page 406, relative to the recent legislation enacted by the legislatures in this and other states, detrimental to the engineering profession; also the comment by President Waid of the State Board of Registration of Architects, appearing in the issue of May 13, page 651.

Although I have frequently had occasion to file plans (as architect and engineer), which have been approved by the Bureau of Buildings of New York City, I found that according to the wording of the present law in regard to registration engineers practising architecture would not be permitted to use the title "architect." It was only after I had written to the Department of Education calling attention to this unfair discrimination against engineers, and pointing out that this law if so applied against engineers would be found to be unconstitutional, that a ruling was finally received from the Attorney-General of this state to the effect that engineers or anyone else may practice architecture, but shall not be permitted to use the term "registered architect."

It seems to me, therefore, that a law of this character is worse than none at all, and is, therefore, only a farce. Would it not be far better to require that architects as well as engineers be obliged to give proof of actual work accomplished, before permitting them to practice their profession under a license of a state? Would it not also be much better for our professional societies to require proof of actual work accomplished, instead of depending upon a long list of references and taking it for granted that the qualifications given in the application represent work actually accomplished by the applicant?

The writer knows of several men who have become members of one of our engineering societies, although they have neither had the education nor the experience of engineers, but who now use their membership in that society as a means of obtaining work which they themselves are not in position to execute, but arrange with other engineers to do, and divide the fees obtained therefrom. If the co-operation of the architect and the engineer could be secured, legislation, no doubt, could be effected which would be of great advantage to both. MAURICE DEUTSCH,
Consulting Engineer.
New York City.

The Waste at Niagara

SIR: The enclosed clipping, taken in turn from the *Christian Science Monitor*, appeared on the editorial page of the Chicago *Herald* of May 18, 1916, and I believe it represents the sentiment of a large majority of influential citizens of the United States, and furthermore I am happy to say this movement is growing all the time. Its results are being manifested in the National Parks created by the government, and in many states tracts of land of exceptional natural beauty are being conserved as state parks.

I am certain that civilization has progressed far enough in the United States to prevent Niagara Falls, long known as one of the wonders of the world and for many years a source of pleasure and inspiration to thousands, from being exploited and ruined for the selfish ends of a few capitalists.

LEWIS B. MAYO, JR.
River Forest, Ill.

[The clipping referred to reads as follows.—EDITOR.]

One of these days the United States and Canada will come into agreement on the point that the way to preserve Niagara Falls is to internationalize the Niagara zone; that is, if they are agreed, in the first place, as to the wisdom of preserving them. So long as any part of the power of Niagara River is used for commercial purposes, that part of it which is not so used will be sought by private interests or municipalities. The only safe way to handle the matter is to remove the river and its falls from the possibility of commercialization.

1915 Lumber Cut Less Than in 1914

The final estimate of the lumber cut of the United States for 1915, as announced by the U. S. Forest Service, is 37,013,294,000 ft. b.m., a decrease in production as compared with 1914 of 332,729,000 ft. b.m.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

"Subcontractors' Room" Makes Figuring Easy and Saves Plans

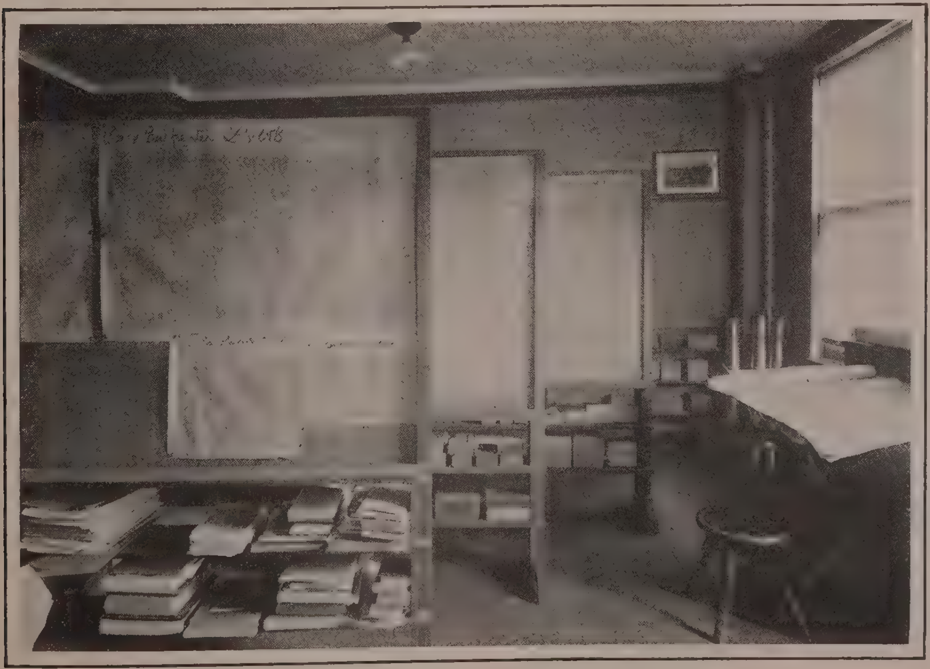
THE ROOM shown in the accompanying photograph is referred to by the Shepherd Construction Company, in whose main office at Wilkes-Barre, Pa., it is located, as the "subcontractors' room." In it, on four large double drawing racks and on other drawing racks running around the room on all dead walls are displayed the drawings, blueprints and details upon which bids are desired from various subcontractors. Convenient to these racks is a drawing board with materials for the use of those estimating on the work displayed.

These racks are about 7 ft. high, and as they are in a 15-ft. square room, they are about 9 ft. long. Below the counter shelves, which are 3 ft. from the floor, are shelves opening on both sides of the racks on which are placed samples of building materials of every description, together with books, catalogs and other data required by the estimators.

The room is light and entirely secluded. Contractors can take their scratch pads and rules, walk from drawing to drawing without interfering with each other, and secure with the least possible trouble all the information they need.

In this way the Shepherd Construction Company is able to accommodate a great many people who wish to figure on different parts of their building work without having the usual tedious delay of sending out plans and specifications and awaiting their return to send them out again to the next man.

It may be taken for granted that the room furnishes to any clients of the company who happen to look in there impressive visual evidence of the volume and character of work the company has under way.



DISPLAY ROOM FOR PLANS MAKES IT POSSIBLE TO GET SUBCONTRACT BIDS IN QUICKLY

Accounting for the Contractor—Cash Book and Check Register

BY BENJAMIN L. LATHROP
Of Lathrop, Shea & Henwood Company,
Scranton, Pa.

THE ADVANTAGES of a combined cash book and check register may be summed up as follows:

(1) The checks may be blocked into neat pads, occupying less room than the ordinary check-book, eliminating the useless stubs, and saving a duplication of entries and repeated forwardings of totals.

(2) The bank balance is readily ascertainable without thumbing over a lot of stubs.

(3) Instead of pasting the cancelled checks back into the check book, a practice in more general use than might be suspected, they are simply arranged in numerical order, and, with a memorandum of checks still "out," placed in a document file, or other space provided for their storage. Herewith is shown, condensed, a satisfactory form for the folio page of a combined cash book and check register.

If more than one bank account is kept from the general office, the principal one should be run through the cash book. The others, however, can readily be handled through journal entries from check stubs, unless all the bank accounts are very active, in which case a more elaborate check register can very readily be devised, following the general principles outlined, but with special columns added for the different bank accounts.

Petty cash can be recorded on an invoice folder, and the items entered collectively through the journal, or direct to the ledger, at the end of the month.

Page No. 25
Dr. Cash

1916			
Jan. 2	Balance forward		2911.40
5	Rec'd. of Martin & Co. on a/c	$150.00 v	
8	Portland R.R. Freight refund	7.50 v	
15	Pacific S.S. Co. Final estimate	7422.25 v	
23	Leeds Mfg. Co. Estimate	1080.00 v	
28	Neal & Co. on a/c	500.00 v	
	Cash, Dr.		v 9159.75
			12071.15

Page No. 25
Cash Cr.

1916				
Jan. 2	Pd. B. H. Howard & Co. Ck. No.	611-v	45.00	
15	Calvin & Co.	612-v	109.50	
	E. F. Fraser	613-v	8.00	
	G. H. Ingersoll	614-v	10.00	
20	Leeds, Dec. Payroll (Ck. to B. H. Howard, paymaster)	615-v	475.50	
30	Portland R. R. Co., Freight	616-v	250.00	
	Cash Cr.	v		898.00
	Balance forward			11173.15
				12071.15

While on the subject of cash, it is doubtless in order to discuss the matter of checks and vouchers. There are so many forms in use that it seems unnecessary to submit specimens. Ordinarily the simplest form is the best. Where a separate voucher is mailed with the check, it should, as a rule, bear the same number as that on the check. The separate voucher system is condemned by some on the ground that it is wasteful and annoying, involving the expenditure of return postage by the recipient. On the other hand, the folded voucher check is generally cumbersome and awkward to handle. Perhaps the most satisfactory solution is the ordinary straight bank check on the back of which is printed:

The endorsement below is acceptance of payment in full of the following items:

			$	
		Total		

If the check covers a long list of items it is not necessary to enter them in detail—just insert the words "Statement rendered to ———" and set down the full amount.

Steam Shovel Time Saved by Making Roadway Cuts by Halves

The use of the steam shovel is becoming common on highway work. Some contractors make their cuts all the way across and fill their wagons by a full 180-deg. turn.

Time could be saved by cutting half the width completely through and filling the wagons by a quarter turn of the boom.

Truck and Trailer Move 60-Ton Steam Shovel Economically

BY EVERETT N. BRYAN
Modesto, Cal.

A MARION model 60 steam shovel belonging to T. K. Beard was recently dismantled, hauled a distance of 32 mi. by truck and trailer from La Grange to Modesto, Cal., and assembled there at a cost of $1,186.60. This compares with another move made by the same shovel, 22 mi. by railroad and 17 mi. under its own power, which cost $3,974.39.

Before the move was begun the shovel stood 300 ft. from the nearest point on the highway in a hole 50 ft. deep. A road 750 ft. long was graded at a cost of $56.62, up which the shovel was moved to the highway for $218.18. The most of the rise was accomplished in a 200-ft. stretch of 18 per cent grade up which the shovel hauled itself with wire rope tackle. The shovel was then completely dismantled at a cost of $71.10.

Assistance to the truck driver and his helper in loading cost $34.94, and moving some of the heaviest parts on wagons drawn by cable a distance of 300 ft. across a high light bridge cost $37.76.

It took a 5-ton Locomobile truck drawing a wagon trailer nine trips to transport the shovel to Modesto. Including interest, insurance, depreciation on truck and trailer, repairs and rent, the transportation amounted to $441.75. The largest and heaviest single piece carried is shown in the photograph. It was the main frame with decking attached, and was 10 ft. wide, 35 ft. long and weighed 10½ tons. Its forward end was supported on a special bolster just forward of the rear wheels of the truck, and the rear end was carried on the rear truck of a 5-ton freight wagon. The trailer wheels failed on the trip and had to be renewed, but the truck came through safely.

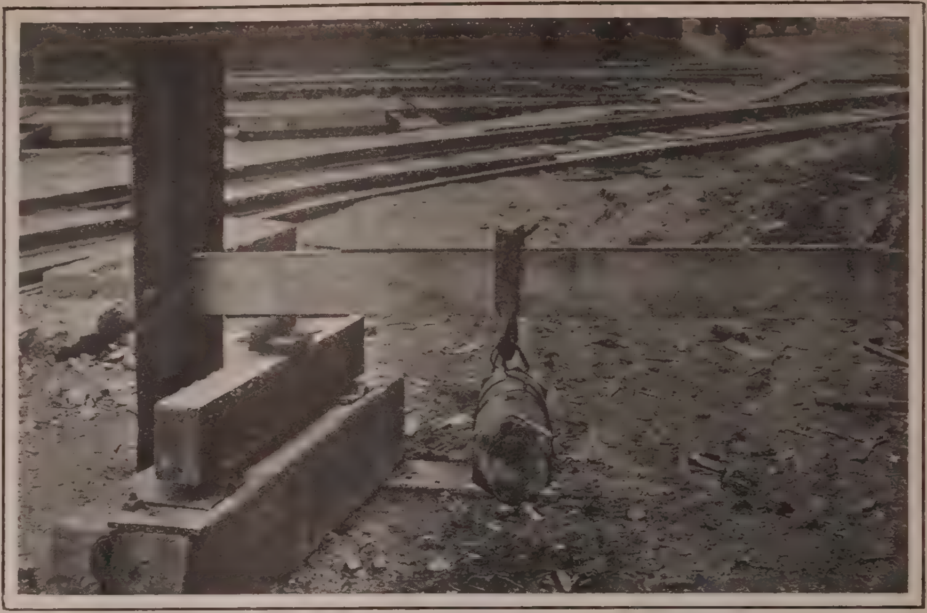
Assistance costing $11.40 was rendered the truck driver and his helper in unloading. While it took 21 8-man days to dismantle the shovel, it was completely reassembled in 43 5-man days at a cost of $194.45. The cost of getting the necessary tools, lumber and other equipment on the ground for the work of moving, and returning them after the shovel was ready for use, amounted to $46.40, and $50 would be a fair charge for rent on this equipment. It cost $20 additional to replace broken fire brick, lumber and small items.

A small crew was used and no effort was made at speed, although the shovel was ready for service 61 days after the work started. This time could probably have been cut in half if sufficient effort had been made. The work was supervised by William Lehlmkuhl, who also handled the shovel on its previous trip above referred to. On this occasion, it took 49 days working with all possible speed for the shovel to make the land and rail journey, ford the Tuolumne River and dig its way into the main canal of the Turlock irrigation district.

TEN-TON UNDERFRAME OF STEAM SHOVEL MAKES 32-MILE MOTOR TRUCK TRIP

Machine Tests Samples of Concrete Before Removing Arch Forms

By HAROLD E. KETCHUM
Superintendent The Hunkin-Conkey Construction Co., Cleveland, Ohio



REMOVAL OF FORMS FROM 175-FOOT ARCHES DETERMINED BY A SIMPLE TESTING MACHINE

THE MACHINE shown in the accompanying photograph for testing specimens of concrete used in pouring the arch ribs of the Detroit-Superior high level bridge in Cleveland was made on the work from material at hand for about $5. It consists of a 12 x 12-in. timber 4 ft. long bolted to two 6 x 8-in. sills of the same length, which are buried flush with the ground. The lever arm is hinged on a ¾-in. bolt through two 4 x 4-in. uprights. As may be seen in the photograph, the lever arm is shod with ¼ x 1½-in. iron on its upper edge and also on its lower edge near the point of support. The load is applied to the test piece by moving a 216-lb. weight suspended from the lever by means of a roller which is turned by hand.

The test specimens, which are made in the form, of plain concrete, are 3 ft. long, 4 in. wide, and 6 in. deep. One of them is shown in the machine. They are placed on knife-edge supports 30 in. center to center on the 12 x 12-in. timber, and a knife edge is placed on top of the beam at its center. A roller is used to transmit the load from the lever arm to the central knife edge.

In making a test one of the operators follows the load out with a pencil, the final position of which indicates the lever arm when the beam drops. As the deflection of a plain concrete beam is negligible, the fixed knife edge supports and the movement of the lever arm do not affect the accuracy of the results. The test specimens of 1:2:4 concrete 14 days old show a strength of from 250 lb. per square inch to 400 lb. per square inch, depending on the weather. A strength of 275 lb. per square inch is considered sufficient to warrant the removal of arch centers, the arch spans being from 130 to 175 ft. This simple machine represents a considerable saving over the cost of having the specimens tested in a laboratory, which was done at first.

The Detroit-Superior bridge is being built in the city of Cleveland by the Hunkin-Conkey Construction Company for Cuyahoga County, for which K. B. Cowan is resident engineer.

Domestic Sales of Motor Trucks 100 Per Cent Greater in 1915 Than in 1914

Domestic sales of motor trucks and delivery wagons in the United States during 1915 were 100 per cent greater than in 1914, according to Harry Wilkin Perry, secretary of the commercial vehicle committee of the National Association of Automobile Manufacturers, in an article published in the *Literary Digest*. The European war has had the effect of tripling the productive capacity of American truck factories. One of the most important developments of the past two years has been a greatly increased output of light trucks and low-priced delivery wagons. The tendency is toward the production of cheaper machines without sacrifice in quality.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

With Imposing Ceremony Massachusetts Institute Dedicates New $7,000,000 Buildings

Masque Portraying Subjection of Elementary Forces by Science—Formal Dedication and Telephonic Banquet Main Features

With imposing pageantry, impressive formal exercises and an enthusiastic gathering at a banquet in which transcontinental telephony played the chief rôle, the Massachusetts Institute of Technology dedicated this week its new $7,000,000 home on the bank of the Charles River in Cambridge, Mass. Drawn by the importance of the ceremony, making a new epoch in the institute's life, alumni from every part of the land and from foreign countries flocked to Boston to take their part in the great event—to wish their alma mater godspeed in the larger work made possible by her new environment and by her co-operative agreement with Harvard.

Ceremonies Opened Monday

The ceremonies opened Monday with farewells to the present buildings. Tuesday evening with medieval pomp the seal, the charter and the archives were carried from the old to the new buildings. A solemn procession garbed in the costumes of the Middle Ages carried the treasures to the bucentaur, a stately barge built in the Venetian fashion. In the glare of searchlights on either bank the vessel made her way across the Charles River to the Cambridge side. Dr. Richard C. Maclaurin, president of the institute, and Samuel McCall, governor of Massachusetts, with appropriate escorts, awaited the barge, received the archives and seal and deposited them in their place of keeping. Then followed in the great court the "Masque of Power."

The masque began by showing Chaos—the elemental powers running riot. Wit, Wisdom, and Righteousness conquered the elemental forces one by one and Art and Science followed where Chaos had been. Superbly conceived, staged and acted, the masque was an excellent prelude to the formal exercises to follow.

Dedication Attended by 8000

The formal dedication exercises, attended by more than 8000 people, were held in the great court Wednesday afternoon. From '68 to '16, every class was represented, each class group in the alumni procession being preceded by its banner in the class colors. Following the alumni came a distinguished body comprising the corporation of the institute, delegates from learned societies and from other colleges, men prominent in engineering and in the affairs of the State of Massachusetts and of the nation. The dedicatory address by the president of the institute, Doctor Maclaurin, was very brief—"To science linked with industry" was his dedication phrase. The governor of Massachusetts followed, laying emphasis upon the idea that the material improvements just dedicated and the technical instruction to which they will conduce are of no avail unless they lead to spiritual betterment.

President Lowell, of Harvard, pointed out that the most enduring of human institutions are the centers of higher learning, citing the history of the universities of Bologna and Paris, which have flourished despite all the vicissitudes through which their states have passed. Such institutions, centers of enlightenment and spiritual power, are worthy of the most lavish gifts that can be showered on them. Henry Cabot Lodge, senior United States Senator from Massachusetts, closed the exercises with a warning to young men of education against closing their minds to the accomplishments of older people and of those who have gone before. He appealed to every educated person to remember that he is a unit in the making of the nation and to discharge faithfully the duty following from his relation to the state.

The closing feature of the dedication program was a formal banquet at Symphony Hall Wednesday night. Fifteen hundred alumni sat down to tables and 1500 spectators, alumni and guests filled the galleries. At every seat at the tables and in the galleries was a telephone receiver. The exercises were conducted through the courtesy of the American Telephone & Telegraph Company entirely over the long-distance wire. Technology clubs at thirty-six cities were on the line, every person in every city having an individual receiver. The cheers of San Francisco, Los Angeles and other points were clearly heard in Boston, while an occasional deafening roar told that all the clubs were cheering at once. Long-distance addresses were made in Boston by Charles A. Stone, President Maclaurin, Prof. Michael Pupin, Dr. Alexander Graham Bell, Orville Wright, Prof. C. R. Cross, President Lowell and T. Coleman du Pont. In San Francisco, Prof. Harris J. Ryan made a wire address; in Chicago, President Judson, of the University of Chicago; in Seattle, Judge Thomas Burke.

Gifts of $1,000,000 Announced

Gifts of $1,000,000 toward an endowment were announced, $800,000 of this being given by three members of the du Pont family. The mysterious "Mr. Smith," donor of the $3,500,000 for the new buildings, will, it was announced, give $5 to every $3 otherwise raised for endowment, his gift, however, not to exceed $2,500,000. The gifts from others, announced Wednesday, assure, therefore, $1,600,000 of Smith money.

At the Wednesday commencement exercises degrees were conferred upon 375 candidates—the largest number in a single year in the institute's record. An admirable exhibit of engineering progress in the last half-century was a feature at the new buildings.

President Maclaurin announced that the two smaller courts in the new group of buildings were to be known as du Pont and Lowell courts after T. Coleman du Pont and Augustus Lowell, the latter the father of Harvard's president.

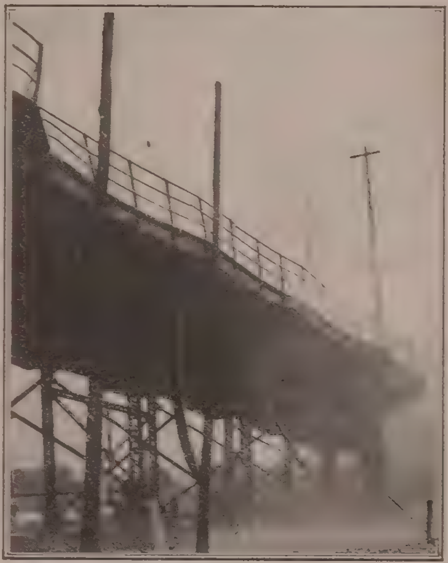
The exercises were closed with the playing of the "Star Spangled Banner" at Washington and formal good-nights from President Maclaurin to the thirty-six clubs on the wire.

Will Hold Better Community Conference in Illinois

A "better community" conference will be held at the University of Illinois, June 20, 21 and 22. This precedes a campaign for stimulating civic improvements so that Illinois can make a good showing in civic progressiveness at the centennial celebration in 1918 of the admission of the state into the Union. The program will provide for liberal discussion of the need of waterworks. The Illinois section of the American Waterworks Association is working for a big attendance. Professor Hieronymus, of the University of Illinois, has charge of arrangements.

Fire in Wood-Block Flooring Twists Steel of Omaha Viaduct

A fire, June 8, which originated from the overturning of a tar kettle being used in laying the cedar-block pavement of the new Locust Street viaduct at Omaha, Neb., spread rapidly over about 500 ft. of the bridge. The new structure, not yet completed, is being built by the Missouri Pacific Railway at a cost of about $275,000. The damage caused by the fire is roughly estimated at $50,000. About 350 ft. of the viaduct floor steel was so warped and twisted by the heat that it will have to be replaced. A large piece of the concrete in the east abutment was broken off. The Bates steel pole shown in the photograph was the only one of the three poles subjected to the heat of the fire which showed any bending effects. Some of the steel I-beam stringers were badly bent and twisted, especially those observed in the photograph, which have broken away from the brackets and dropped toward the ground. A high wind was responsible for the great heat and rapid spread of the flames.



HEAT WARPS AND TWISTS STEEL VIADUCT

Damages Alleged Due to Levee Construction Denied by Court

A decision has just been handed down by the United States Supreme Court stating that the Mississippi River Commission cannot be enjoined from constructing or repairing levees. The decision was announced in one of a series of suits begun in the federal district courts in four Southern states by a citizen of Memphis in behalf of himself and the Riparian Land Owners' Association against the Mississippi River Commission and various state levee boards. The argument of the claimants that the river bed and valley were identical was held to be inconsistent. The court decided that damages alleged to result from the building of levees cannot be recovered.

Phoenix, Ariz., to Enlarge Canal

The city commission of Phoenix, Ariz., has instructed the city attorney to take immediate action toward eliminating the Salt River Valley canal which passes through that city. The water will be carried outside of the city limits by the Maricopa Canal, which will be enlarged. The work will cost nearly $53,000.

Course at Tech Includes Study in Industrial Plants

Chemical-Engineering Students to Spend Year Studying in Six Big Plants of the Industry—Offers Practical Experience

In order to acquaint students with actual manufacturing conditions the new school of chemical engineering at the Massachusetts Institute of Technology will include nine months' study at various industrial plants. Five plants have already been selected, at each of which one professor will be stationed. Students will spend approximately six weeks at each plant. A special building to be constructed at each station will contain a library as well as a lecture room.

The student spends the first three and a half years of the course in obtaining a knowledge of the fundamentals of chemistry and engineering. The next nine months are given to study in five or six industrial plants. The last nine months are devoted to laboratory work at Cambridge in the buildings just dedicated. The students will be divided into as many groups as there are stations and spend about six weeks in each until the whole cycle is completed.

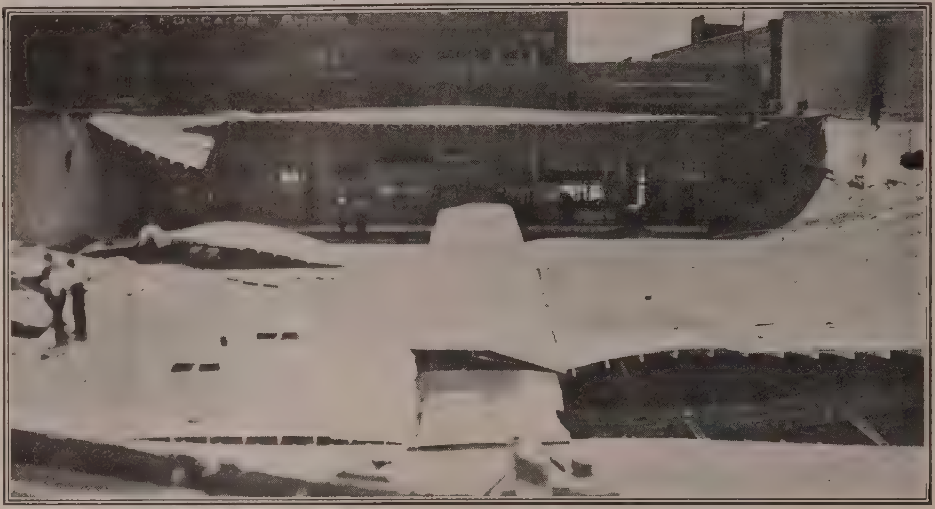
Five stations have been selected. One is to be established at Somerville for the study of fuels and combustion. The laboratory will be in connection with the works of the New England Gas & Coke Company. A second will be in the Eastern Manufacturing Company's plant at Bangor, Me., where the broad applications of electricity at comparatively low temperatures will be studied. At Niagara Falls a station will be established in connection with the Exolon Manufacturing Company, where investigation will be made of electricity at high temperatures. Inorganic chemistry will be the general line of investigation at the works of the Atlas Cement Company, at Allentown, Pa. The fifth station will be with one of the great chemical industries near New York or Chicago.

Dallas County to Improve Roads

A report on the proposed plan of completing the Dallas County (Tex.) road system by building roadways above high water or constructing concrete roads over which water may flow was ordered recently. Approximate estimates of the cost will also be made, and the complete report will be presented in about thirty days. Concrete culverts are expected to be used to a large extent.

Roof Collapses—Kills Three

The roof of the Casino skating rink building at Atlanta, Ga., collapsed June 9, killing three people and injuring ten. The roof of the 100 x 150-ft. building appears to have slipped toward the rear of the structure and slid down between the walls to the position shown in the picture. The blame for the accident has not yet been fixed.



ROOF OF BUILDING IN ATLANTA COLLAPSES—CAUSE UNKNOWN

The roof was supported by wooden arches, the members of which were bolted together and stiffened with iron rods. The arches rested in offsets in the brick side walls. The whole structure is said to have been a cheap and unsafe job. Poor material and workmanship are reported as probable causes contributing to the accident.

Road Supervisors Indicted for Neglecting Highways

Judge Ryan, of Doylestown, Pa., at the opening of the June criminal court told the jury that if reported bad road conditions in Bucks County were evidently caused by neglect of supervisors, indictments should be returned to that effect. As a result two supervisors were charged with maintaining public nuisances in allowing undesirable road conditions to exist in their townships.

Everybody—Even the Governor—Works on Pennsylvania Good-Roads Day

GOVERNOR BRUMBAUGH WAS AN ENTHUSIASTIC WORKER RECENTLY, WHEN THE MEN, WOMEN AND CHILDREN OF PENNSYLVANIA TURNED OUT TO WORK ON THE ROADS. THE MAN TO THE LEFT (STOOPING) IS THE GOVERNOR OF PENNSYLVANIA.

Fire Destroys $150,000 Wooden Pier at San Francisco

A fire on pier 46 at San Francisco completely destroyed that structure June 4. The damage to the pier is said to amount to $150,000—its construction cost. Merchandise on the pier valued at more than $1,000,000 was also reduced to ashes. No lives were lost, although several men had narrow escapes.

The cause of the fire is unknown. A small fire broke out under the bulkhead June 3, but was reported by the fire department to be completely extinguished. At 10 o'clock the next morning flames burst through the floor of the 200 x 800-ft. pier shed and spread so rapidly that it was impossible to check them. Officials of the Luckenbach Steamship Company, lessee of the dock, are reported as favoring a concrete structure to replace that destroyed.

County Commissioners of Washington Will Meet in September

W. H. Reed, of Tacoma, commissioner of Pierce County, Washington, is arranging for a meeting Sept. 14, 15 and 16 of the State Association of County Commissioners, of which he is president. Among the speakers who will address the convention are Rufus C. Holman, commissioner of Multnomah County and president of the Oregon State Association of County Judges and Commissioners, who will discuss efficiency and economy in county government; Almon H. Fuller, dean of engineering, University of Washington, whose lecture will be on highway bridges. Dr. H. K. Benson, professor of industrial chemistry, University of Washington, will present a paper on road bitumens. The county engineers of the State of Washington may hold a joint meeting with the commissioners if arrangements can be made.

2330 Chicago Engineers March

The recent preparedness parade in Chicago included in its 130,000 marchers 2330 engineers headed by members of the Naval Consulting Board. Bion J. Arnold, member of the National Naval Consulting Board, was accompanied by four members of the Illinois board, Robert W. Hunt, F. K. Copeland, Peter Junkersfeld and William Hoskins, and by one member of the Michigan board, Gardner S. Williams. Wharton Clay, marshal of the section, had H. S. Baker, E. H. Lee and D. K. Tomlinson as his aides. Each aide had command of a division headed by a band. The newspapers said that the engineers' division was one of the best organized sections. Two thousand cadets of the University of Illinois, one-half of whom were engineering students, took part in the parade.

American Waterworks Association Seeks to Improve Service to Its Members

Changes in Administrative Policy Foreshadowed in Presidential Address of N. S. Hill, Jr., at Annual Convention in New York, June 5 to 9

The keynote of the thirty-sixth annual convention of the American Waterworks Association, which concluded its five-day session at the Hotel Astor, New York City, June 9, with a registered attendance of about 1200 active members, associates and guests, was sounded in the address of the retiring president, Nicholas S. Hill, Jr., when he made a plea for enlarging the scope of the service of the organization to its members. Radical changes in the administrative policy of the association were foreshadowed by his remarks, among them being the separation of the duties of secretary and editor and the appointment of a trained man to perform the new editorial duties proposed. The need for co-ordination of the local sections and the parent body was emphasized, and the suggestion made that part of the association's funds be appropriated for improving the quality of its committee work. Great stress was laid upon the necessity for enhancing the value of the association's technical papers and printed proceedings. In fact, the whole tone of President Hill's speech, an abstract of which was published in last week's issue, page 766, indicated that the association was awakening to a realization of greater opportunities. The prediction was freely made that the incoming administration, under the leadership of Leonard Metcalf, the newly elected president, would write a new page of progress in the association's history.

Of the technical papers the one entitled "The Typhoid Toll," by George A. Johnson, was undoubtedly the feature of the convention. It told how 3000 lives could be saved annually by the filtration of city water supplies and presented the case for pure water in a forceful and easily understandable manner. This contribution elicited more discussion than any other paper on the program. Among the other technical papers the one on pumping machinery, by J. N. Chester, and that on reservoirs, by Dabney H. Maury, were received with marked favor by the delegates.

As usual, a number of committee reports were scheduled for presentation, but few were made in a form other than that of "progress." An innovation this year was the creation of a committee on city planning, and its report, presented by the chairman, E. P. Goodrich, consulting engineer, of New York City. It easily overshadowed any of the others in point of general interest, although the report of the committee on electrolysis, by Prof. Albert F. Ganz, called forth a vehement protest from Dabney H. Maury, who objected to the American Waterworks Association's participation in the work of the Joint National Committee on Electrolysis. This body, he charged, was so constituted that members of the waterworks industry could hope to exert very little influence in its deliberations.

Superintendent's Day, which had been heralded as an all-day forum for the discussion of practical waterworks problems by practical men, was cut short at the close of the morning session Thursday, and the afternoon period was given over to an organ recital in the grand ballroom of the Hotel Astor, where, incidentally, the exhibit of waterworks equipment and supplies was staged. The superintendents expressed a great deal of dissatisfaction at this move, which resulted in the passage of a resolution calling for at least two, and if possible three sessions for superintendents at future conventions.

New Officers

As a result of a letter ballot the following officers were elected for the ensuing year: President, Leonard Metcalf, consulting engineer, of Boston, Mass.; vice-president, Theodore A. Leisen, general superintendent, Board of Water Commissioners, Detroit, Mich.; treasurer, James M. Caird, consulting engineer, Troy, N. Y.; trustees, F. W. Cappelen, city engineer, Minneapolis, and M. L. Worrell, general manager of waterworks, Meridian, Miss. The executive committee reappointed J. M. Diven secretary for the ensuing year and referred to the publication committee, for report, the matter of securing an editor for the association's publications.

Richmond, Va., was chosen as the scene of the 1917 annual convention, and the following nominating committee was selected to name candidates for office next year: George A. Johnson, consulting engineer, New York City; Edward E. Wall, water commissioner, St. Louis, Mo.; Frank C. Jordan, secretary, Indianapolis Water Company; H. Hymmen, superintendent of waterworks, Berlin, Ont., and George W. Batchelder, water commissioner, Worcester, Mass.

New Membership Record

That the association is in a flourishing condition, both financially and in regard to membership, was made clear at the opening session June 6, when the regular committees made their reports. Secretary Diven reported a net gain in membership of 103 during the year, the figures being: Active members, 1123; corporate members, 79; associate members, 123; honorary members, 7—a total of 1332.

For the finance committee, H. E. Keeler, of Chicago, announced a new era in the association's history. There are no unpaid bills and the organization has about $7,000 in the bank. Of this amount about $3,000 represents the cash balance and the remaining $4,000 an investment in municipal bonds. These figures were elaborated in the report of the treasurer, J. M. Caird. Last year the finance committee regulated its expenditures according to a budget system, which has proved so successful, according to Mr. Keeler, that it will be repeated this year. He presented for approval a budget calling for an expenditure of about $10,000 this year. Some of the items are: Convention, $700; committee work, $400; local sections, $500; secretary, $1,800; printing $5,000; contingencies, $500.

The formation of local sections, according to the report of John W. Alvord, who spoke for the publication committee, has increased the printing bill and general cost of issuing the *Journal*, but in view of the association's present satisfactory financial status no embarrassment is anticipated in meeting the heavier obligations.

Special Investigations

Committee reports were the order of the day during the afternoon session of June 6. Of nine committees scheduled to present their findings, only one submitted a final report, and this dealt with standard specifications for hydrants and valves. It was presented by B. C. Little, who told the convention of the co-operative work which had been done by his committee and a similar committee of the New England Waterworks Association. The two bodies were able to agree on all except three points. The differences of opinion related to friction losses in hydrants, nipples and sizes of stems. John H. Gregory submitted a progress report of the committee on standard specifications of cast-iron pipe. This committee also has been working in co-operation with the New England Waterworks Association and with cast-iron pipe manufacturers. Mr. Gregory made a plea for funds in order that the work of his committee might be prosecuted effectively.

What promised to be one of the most important reports was the one of the committee on depreciation, of which Leonard Metcalf is chairman. The report is practically finished now, but inasmuch as there are several points which still need consideration by the full membership of the committee the presentation of this document was deferred. Scotland G. Highland's report on plumbing codes raised several objections. He advocated that the city water department control plumbing inside a building, but the sense of the meeting seemed to be that this enlargement of the water department's duties would merely add to the present complexities of inspection and permit routine necessary in constructing a building. The report was referred back to the committee.

While the committee on mechanical analysis of sand submitted only a progress report, Edgar M. Hoopes, Jr., city engineer of Wilmington, Del., pointed out that the matter of a standard screen scale for use by all industries is now under consideration by the U. S. Bureau of Standards. During a recent conference with that body representatives of the American Waterworks Association and other technical societies were present. It seems safe to predict that a recommendation will be adopted providing for the rating of screens by the size of opening rather than by the mesh number.

No National Association Yet

That the time is not yet ripe for an amalgamation of the American Waterworks Association and the New England Waterworks Association was made clear from the remarks of Leonard Metcalf in reply to a motion by Dow R. Gwinn, instructing the executive committee to investigate and report upon the matter before the close of this year's convention. Mr. Gwinn favored the coalition of the two bodies and was of the opinion that the time had come for definite action. President Metcalf, however, did not concur in this belief. "It is out of the question at present," he said, "to hope for a single national waterworks association and direct effort toward this end now is ill-advised. In fact, it might have the effect of creating a breach between the two associations. While the two organizations are to-day closer together than ever before, a consolidation, if it ever does come, must come gradually and not by forced effort."

Some of the major elements that tend to reduce pumping-plant efficiency were discussed in a paper by J. N. Chester, consulting engineer, of Pittsburgh (see page 804). In many instances, he said, from 20 to only 5 per cent of the heat in coal fired under boilers is converted into useful work, and he undertook to show some of the causes which account for this slow efficiency. In the discussion Capt. H. G. H. Tarr spoke of the need for "hitching up engineering to the dollar," and advocated consideration of the human, as well as the mechanical, problem in securing pumping-plant efficiency. He went on record in favor of giving bonuses to firemen who succeed in running their boilers on less than a specified quantity of coal.

Protest on Electrolysis

What was characterized by President Leonard Metcalf as a "frank, fearless and splendid stand" was taken by Dabney H. Maury, consulting engineer, of Chicago, when he made a vehement protest against the participation by the American Waterworks Association in the work of the Joint National Committee on Electrolysis, which has in preparation a report dealing with the subject of stray electric currents and their effect on subsurface structures. This national committee, Mr. Maury stated, is made up of three members each from the following organizations: American Waterworks Association, American Gas

Institute, National Gas Association, American Telegraph & Telephone Company, National Electric Light Association, American Railway Engineering Association, American Electric Railway Association and the American Institute of Electrical Engineers. In addition, the U. S. Bureau of Standards is represented by one member. Mr. Maury was explicit in stating that the national committee's membership indicated a preponderance in favor of the electric and street railway interests and that members of the American Waterworks Association, concerned solely with the integrity of subsurface pipe lines, could expect to wield little influence in its deliberations. His excoriation was precipitated by the report of the American Waterworks Association's committee on electrolysis, presented by Albert F. Ganz, professor of electrical engineering at the Stevens Institute of Technology.

Taking up the composition of the National Joint Committee on Electrolysis Mr. Maury contended that there existed a community of interest between the gas and electric industries and that it was misleading to say, as Professor Ganz had done, that pipe owners could be considered to have a majority control of the committee. On the contrary, he stated, the waterworks men were hopelessly in the minority.

Professor Ganz Replies to Critics

Professor Ganz replied to his critics by stating that the action of the national joint committee could not be considered as binding upon the association which had appointed representatives to it. He believed that the formation of the national committee was a step forward in adjusting the differences between the street railway companies and the interests concerned with metallic pipe lines. He did not see in the joint committee work the menace which was hinted at by Mr. Maury. Professor Ganz said that the association's former committee report, submitted when Mr. Maury was chairman, was exceedingly drastic and prescribed results which were impossible of attainment. The older report, he pointed out, required, in effect, a double trolley system, a feature which, in his opinion, there is small possibility of inducing the street railways to adopt. "We can provide adequate means of safeguarding pipe lines," said Professor Ganz, "without changing from the single to the double trolley." After a prolonged discussion the report of the committee on electrolysis was ordered received, but not approved. It was also provided that a committee be continued in power for further investigation of the subject.

Chemical and Bacteriological Section

By building a plant costing $30,000 to reclaim lime from the sludge in the settling basins at its filtration plant the waterworks department of Columbus, Ohio, according to Charles P. Hoover's paper, presented at the meeting of the chemical and bacteriological section June 8, estimates that a saving of $9,000 per year will be realized in the cost of lime alone. An abstract of Mr. Hoover's paper appears on page 806.

Some of the problems which confront the staff of the state water laboratory were discussed by L. H. Van Buskirk of the Ohio State Board of Health. Mr. Van Buskirk made a plea for uniformity of methods in the collection and shipment of samples of water for analysis. In the interpretation of results, it was pointed out, an inspection of the source of supply should be given great weight. Tests for B. coli as indicators of water pollution were discussed by Prof. C. E. A. Winslow.

City Planning

In presenting his committee report, E. P. Goodrich defined city planning as foresight in municipal matters. He called attention to the possibilities of the joint use of park lands and cited a case at Baltimore where a golf course flanks the Lake Montebello reservoir. A questionnaire on the subject of subsurface pipe galleries brought out the opinion that utility galleries are economical only for large cities. The report pointed to the undeveloped field of usefulness for the subsurface water hydrant in localities where snow and ice do not prevail during the winter months. At the present time, according to Allen Hazen, no American manufacturer is making a subsurface hydrant, and he believes that it might find favor in some of the cities on the Pacific Coast and in the South.

Dabney H. Maury's paper on reservoirs brought forth a discussion in which many members participated. His paper is published in abstract on page 803.

The Typhoid Toll

Toward the end of the final session of the convention, at about noon, June 9, President Hill called upon George A. Johnson for his paper entitled "The Typhoid Toll" (see page 803). The paper had been originally scheduled for the evening session of June 7, but had to be postponed because the greater part of the evening was taken up in listening to speeches presenting claims of various cities for the next convention of the association and in balloting—two votes being necessary before a majority was secured. In announcing Mr. Johnson's paper President Hill had some difficulty in recalling its title, and there was a slight pause while he hunted through his program to find it. "I don't wonder that Mr. Hill has forgotten the title of my paper," said Mr. Johnson, "as I have waited so long to deliver it that I have almost forgotten it myself."

Mr. Johnson confined his remarks merely to a brief résumé of his paper, which had been printed in the association's *Journal*. Judging by the amount of discussion which followed, Mr. Johnson's paper created a more widespread interest than any single contribution offered to the convention during its five-day session. Paul Hansen, chief engineer of the Illinois State Board of Health, characterized the paper as a mine of information for health officials who wish to place the typhoid problem before the public in a way that will impress it forcibly. The part-time health officer, he said, is responsible for many of the shortcomings of health departments.

"No greater service can be performed in the interest of public health," said Mr. Hansen, "than to urge, in season and out of season, the employment of the full-time health officer." Mr. Johnson's contention that state boards of health should not be given power to review plans met with opposition from Mr. Hansen. He held that state boards should have such power and that as a check upon unfair rulings a commission of expert engineers be appointed as a sort of court of appeal. Such a plan, it was pointed out, has worked well in Ohio.

Allen Hazen declared that his predictions, regarding the lowering of the death rate by pure water, made many years ago, are now being fulfilled. He sounded a note of warning, however, in referring to chlorination. With the advent of this form of sterilization, he said, there is a tendency to slight the design of filtration works and to depend upon the sterilizing equipment to do the work which should properly be done by the filters.

Facts and Figures Important

The consensus of opinion seemed to be that the facts and figures regarding the prevention of typhoid fever by pure water were important enough to warrant wide publicity. One of the speakers suggested that an elementary course on typhoid and its prevention by filtered water should be made a part of the curriculum of the public schools throughout the country. Theodore Horton, chief of the engineering division of the New York State Department of Health, gave figures to demonstrate how the typhoid curve had been lowered abruptly following the organization of an engineering division to control the purity of water supply. M. N. Baker urged the appointment of sanitary engineers, instead of physicians, as state and city health officers.

There were fifteen written discussions, among them communications from Dr. Harvey W. Wiley and Surgeon-General Rupert Blue, which could not be presented for lack of time. A resolution was passed authorizing the publication of Mr. Johnson's paper in pamphlet form and its distribution to municipal departments and newspapers throughout the country.

Superintendents Object to Curtailment of Their Sessions

Dissatisfaction was expressed at the manner in which Superintendents' Day was handled. The complaints were leveled mainly at the amount of time devoted to hearing the insurance companies' side of the private fire-service question, though allusion was made to the fact that less and less time has been devoted to matters of interest to superintendents at successive conventions during recent years. Secretary Diven replied to the criticisms, in part, by stating that in arranging the program he had received very little assistance from the superintendents themselves. As a result of the discussion a resolution was passed calling upon the president and the executive committee to arrange for three sessions for superintendents at the next convention.

Early in what was scheduled as the morning session the chairman proposed that instead of holding two sessions — morning and afternoon — as the program called for, one schedule lasting until 1.30 p. m. be held. Only one objection was registered against the proposal, and upon being referred to vote the suggestion was unanimously adopted. The entire morning, with the exception of two brief papers and a short time given to closing-up matters, was then given up to a discussion of the private fire-service question.

Insurance Viewpoint Presented

A. H. Blauvelt, associate manager of the Western Factory Insurance Association, of Chicago, opened the discussion by explaining the insurance companies' point of view, although with the reservation that there was very little cohesion or agreement among their representatives in respect to the private fire-service question. The beneficiary from a private fire service, the property owner, should pay, he believed, for the extra service rendered. He held also that the property owner should pay for the cost of installing and maintaining the system. A general installation of such services, it was maintained, would make special provisions for their care on the part of the water company absolutely unavoidable.

The insurance companies are practically agreed that a 4-in. connection for a sprinkler system is all that can be asked for. Joint connection to other sources of supply, according to Mr. Blauvelt, is a dangerous practice on account of the likelihood of contaminated water getting into the mains. All meters are liable to act as trash racks and for that reason provision should be made to bypass around them. The waterworks unquestionably should charge for fire service, he stated. A charge not exceeding $50 has been proved by experience to be collectible without difficulty. A higher charge might be justified, but the likelihood of its being collected without a great deal of trouble would be small.

Following Mr. Blauvelt's paper there was general discussion lasting several hours, the result of which was a resolution, offered by J. M. Diven, that the president and executive board be instructed to appoint a committee to confer with other associations and formulate a set of rules for private fire service. This resolution was opposed on the ground that in such a matter the American Waterworks Association should be sufficient unto itself. The general sense of the gathering was, however, that the insurance companies were vitally concerned in such matters, as were also the manufacturers, and the resolution as finally adopted included the two interests.

A great deal of favorable comment was heard on the excellent arrangements for the convention at the Hotel Astor. The grand ballroom was given over to the exhibits and there were two meeting rooms available for general and special sessions. The promenade afforded a convenient lounge for the members and was used by small groups for informal discussions.

Rain interfered with the entertainment features. The trip to the Kensico dam of the Catskill aqueduct was made during a heavy storm, but as the rain continued on June 9 the trip to Coney Island had to be abandoned. A smoker was substituted for it. On the evening of June 8 there was a reception and dance tendered to the president and delegates by the Waterworks Manufacturers' Association.

More than 70 firms participated in the exhibits, which were well staged in the grand ballroom. Men who have been attending the conventions of the association for many years said that the exhibit was the best in the organization's history.

To stimulate an increase in membership President Hill this year offered a handsome silver cup to the section reporting the greatest per capita increase. The prize was won by the newly formed Canadian section, which showed a gain of 35 per cent.

A. E. Cluett Made Chairman of Troy Harbor Commission

A. E. Cluett, member of the firm of Cluett, Peabody & Company, of Troy, N. Y., has been made chairman of the recently organized harbor and dock commission of that city. Mr. Cluett is a graduate of the Massachusetts Institute of Technology and has superintended the construction of many buildings for his company. The commission will expend nearly $2,000,000 in improving Troy's docks and river front.

Military Engineering Meetings in Chicago End—Drill Begins

Having concluded the course of lectures on military engineering with a paper on "Fortifications" by Capt. H. B. Sauerman, consulting engineer, the joint committee in Chicago has arranged for practical outdoor work. The lectures have accomplished their intended purpose—that of showing the engineer the futility of expecting a commission without military training. For members who cannot join the National Guard or attend training camp, drill was started in Grant Park June 8 and will be continued on Thursday evenings. The strong showing made by the engineers in the preparedness parade accentuated the call for personal instruction. Later in the season there will be exercises in map-sketching in conjunction with the engineer company of the Illinois National Guard, the officers of which have worked in the closest harmony with the joint committee. Before every lecture they have given informal instruction in the rudiments of the routine training.

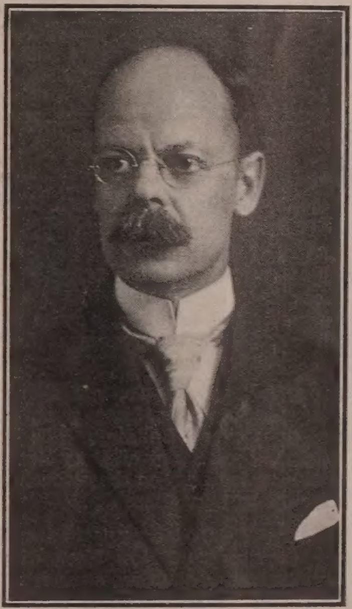
$2,000,000 Fire at Baltimore

A fire on June 13 at Canton, Md., a suburb of Baltimore, destroyed elevator 3 belonging to the Pennsylvania Railroad, damaged two vessels and burned a string of freight cars. It is thought that fourteen men were killed and about forty injured. The damage to the elevator, ships and grain is estimated at $2,000,000. The conflagration is said to have been caused by an explosion of grain dust. The explosion wrecked the upper part of the elevator and the whole building was ablaze in a few minutes. The flames spread to an adjacent pier, where considerable damage was done. The steamships Willem Van Driel, Sr., and Welbeck Hall, which were loading grain, were badly burned and damaged by falling wreckage.

Leonard Metcalf Made President of Waterworks Association

Leonard Metcalf, consulting engineer, of the firm of Metcalf & Eddy, Boston, was installed last week as president of the American Waterworks Association to succeed Nicholas S. Hill, Jr., whose term of office expired. Mr. Metcalf was the unanimous choice of the nominating committee selected at last year's convention and his election is the result of a letter ballot of the membership counted recently. In order that he might be inducted into office Mr. Metcalf made the trip across the continent from San Francisco to the opening session of the convention in New York City.

Elected to the Presidency of American Waterworks Association



LEONARD METCALF

Mr. Metcalf enjoys the distinction of having been honored with the presidency of the country's two greatest waterworks associations—the American and the New England. He was elected to the presidency of the New England Waterworks Association at its annual meeting held in Boston, Jan. 13, 1915, and served at the head of that organization until succeeded this year by William F. Sullivan.

Mr. Metcalf was born in Galveston, Tex., in 1870, and received his degree from the Massachusetts Institute of Technology in 1892. During recent years he has been giving the greater part of his time to matters of valuation and rate making and testifying in legal cases. In this specialized field he is regarded as one of the country's leading authorities. For the last two years he has spent most of his time in California on the case of the Spring Valley Water Company in San Francisco. In collaboration with his partner, Harrison P. Eddy, Mr. Metcalf completed a three-volume work on "American Sewerage Practice."

Town Wants Engineering Advice

The citizens of Mount Pulaski, Ill., are looking for an engineer who can tell them how to rid the waterworks system of moss. The growth in the storage tank during the past year has necessitated turning off the water several times.

Savannah Ocean Terminals Completed

The new terminals of the Ocean Steamship Company at Savannah, Ga., have been completed. They occupy 20 acres along the Savannah River and consist of a slip 1020 ft. long and 225 ft. wide, flanked on the sides by freight sheds with trackage for 225 cars.

Engineering Society Activities

The Boston Society of Civil Engineers will hold a field day June 21 in conjunction with the New England Waterworks Association. The engineers will leave Boston at 10 a. m. for Pemberton. The trip will be made by boat and the program will be nearly the same as last year.

The Society of San Diego County (Cal.) Engineers has been organized for the purpose, it is said, of placing more authentic data before the taxpayers of that county. J. E. Sellers and Paul Watson are president and secretary.

The Colorado Association of Members of the American Society of Civil Engineers held its annual meeting June 10 at Denver. J. B. Lippincott, consulting hydraulic engineer, of Los Angeles, described the work on the Los Angeles aqueduct.

The Rochester Society of Technical Draftsmen will hold regular meetings the last Thursday of each month in the Sibley Block, Rochester, N. Y.

What Engineers and Contractors Are Doing

THE WARRACK CONSTRUCTION COMPANY, of Seattle, has removed its offices to the Lyon Building.

C. S. COE, engineer maintenance-of-way of the Florida East Coast Railway, has been appointed chairman of the Water Works Advisory Board to prepare and submit designs for an adequate and satisfactory water supply for the city of St. Augustine, Fla.

FREDERICK E. BECK, construction engineer for the board of water commissioners of the city of Binghamton, N. Y., has been made superintendent of the pumping stations and filter plants of that city. Mr. Beck has been with the water commissioners eighteen years, previous to which he served in the city engineer's office under the former city engineer, John A. Giles.

B. H. KLYCE and WALTER J. KACKLEY have formed the engineering firm of Klyce & Kackley, with offices in the Life and Casualty Building, Nashville, Tenn., and the Real Estate Building, Miami, Fla., for the practice of municipal, highway and drainage engineering. Mr. Klyce has been engaged in municipal engineering for the past ten years, having recently had charge as consulting engineer of extensive improvements at Miami, Fla. Mr. Kackley has been engaged in bridge and drainage construction in the Middle West and in Florida, having recently completed plans for the drainage of a large section of the Everglades. The new firm has been retained to design and take charge of the proposed $600,000 causeway across Biscayne Bay at Miami, Fla.

MCMAHON, FARRINGTON & BAKER is the name of a new engineering and contracting firm organized to handle heavy concrete design and construction as well as the design and construction of sewage-disposal plants and sewerage systems. The main office of the firm is in the Press Building, Binghamton, N. Y., with branch offices in Owego and Elmira. Mr. McMahon is a graduate of Union College and has had long experience in engineering work on the Panama Canal and several municipal jobs in South America and Mexico. Mr. Farrington is a Cornell graduate and was formerly chief engineer for the Appalachian Power Company on the Virginia transmission line. He was also with J. G. White & Company on power-plant construction at La Crosse, Wis. The firm has a large paving job at Waterloo, N. Y., under way.

De Forest A. Wheelock, who has been city engineer of Warren, Pa., for nearly twenty years, has engaged in the practice of consulting engineering with his son, H. A. Wheelock. Mr. Wheelock, Sr., first took up engineering work in 1874. He made several surveys to establish county boundary lines and was also employed on various railroad construction. From 1883 until 1895 he was engaged on the location and construction of several railways in Pennsylvania, including lumber roads and electric street railways. In 1895 he was made city engineer of Warren, Pa., which position he held until his recent resignation. He has also been chief engineer of the Warren Electric Street Railroad and city engineer of Salamanca, N. Y. Mr. Wheelock, Sr., has been county engineer of Warren County, Pennsylvania.

Alson Rogers has been appointed city engineer of Warren, Pa., succeeding De Forest A. Wheelock, whose resignation is noted elsewhere in this issue.

Gault Applegarth, formerly resident engineer for the Maryland Roads Commission, has been made road commissioner for Chestertown, Md. Mr. Applegarth is a graduate of the engineering department of the International Correspondence School. He took up engineering work in 1904 and was engaged on several surveys during the following three years. He began a private practice as general surveyor in 1907 at Patchogue, N. Y., and in 1908 was made topographer for the Madeira-Memoré Railroad in Brazil. He became connected with the Maryland Roads Commission in 1910. In 1913 he was made resident engineer in charge of construction and maintenance of state roads in Baltimore and Hartford counties, in which capacity he has directed work costing over $1,000,000.

Louis Kampf, formerly with Lockwood, Greene & Company, architects and engineers, on work at Salem, Mass., is now representing several American companies in Shanghai, China.

George R. Campbell has left the U. S. surveyor general's office at Olympia to become U. S. surveyor at Naches, Wash. Mr. Campbell has been engaged in engineering work in the Northwest since 1901. From that year until 1904 he had a consulting practice at The Dalles, Ore. In the latter year he was made a member of the firm of Campbell & Campbell, civil engineers, of Spokane, Wash. He took up private practice again in 1910 and in 1912 became connected with the Department of the Interior.

N. R. Melvin, formerly superintendent on the recently completed Harlem River tunnels of the Lexington Avenue subway, New York City, has been made a member of the Arthur McMullen & Melvin Company, Baltimore. Mr. Melvin has had nearly twenty years' experience in construction work. Aside from his work on the tunnels of the Lexington Avenue subway, he had charge of the construction of the Interborough Rapid Transit crossing under the Harlem River at 145th Street. Mr. Melvin is now superintending the deepening and widening of the main-line double-track tunnels of the Pennsylvania Railroad at Baltimore.

J. A. Beemer, formerly connected with the Bureau of Public Works of Manila, is now engaged in irrigation construction work for the State of Idaho.

C. C. Jacob, district engineer of the U. S. Geological Survey at Phoenix, Ariz., is making a tour of Nevada to collect data regarding that state's streams.

Ellis Tisdal has recently been made assistant engineer in the sanitary engineering division of the West Virginia Department of Health. He is a graduate of Massachusetts Institute of Technology.

Alton A. Cook has been made state chemist for the West Virginia Department of Health.

A. D. Waidle was recently appointed assistant engineer in the division of sanitary engineering of the Department of Health of West Virginia. Mr. Waidle is a graduate of the Massachusetts Institute of Technology.

J. B. Anderson, engineer and contractor, of Pittsburgh, is now superintending the construction of a warehouse for the American Sheet & Tin Plate Company at Canton, Ohio.

J. E. Van Liew, formerly chief engineer of the Des Moines Bridge & Iron Works, has organized the Des Moines Steel Company, at Des Moines, Iowa, to engage in the fabrication of structural steel. Mr. Van Liew was graduated from the electrical-engineering department of Iowa State College in 1899, and from the civil engineering department in 1901. He spent the summers between school terms with different railroads. From 1901 to 1903 he was enmployed by the American Bridge Company at Toledo. He went to the Scherzer Rolling Lift Bridge Company in the latter year and early in 1904 became connected with the American Bridge Company at St. Louis. After about six months with the American Bridge Company Mr. Van Liew entered the employ of the Des Moines Steel & Iron Works, of which he has been chief engineer since 1913.

R. L. Wood has left the employ of the engineering department of the Missouri Pacific-Iron Mountain Railway to join the valuation department of the Atchison, Topeka & Santa Fé Railway, with headquarters at Galveston, Tex.

Leeds & Barnard, consulting engineers, of Los Angeles, have removed their offices to the Central Building. The firm has been retained by the city of Long Beach, Cal., in a consulting capacity on the concrete seawall and sidewalk in Long Beach.

Hansen & Coulter, hydraulic and sanitary engineers, of New York City, have been retained as consulting engineers on the installation of an iron-removal plant for the Jamaica Water Supply Company, of Jamaica, L. I.

C. W. Cooper, who has been actively engaged on construction work in the South since 1909, has been made city engineer of Anniston, Ala. This is in addition to his work as consulting engineer for several other towns in Alabama. Mr. Cooper was graduated from the Alabama Polytechnic Institute in 1908. He recently completed a course in highway engineering at Columbia University, after which he returned to the South.

William D. Wrightson, sanitary engineer for the U. S. Public Health Service at New Orleans, has been given a four months' leave of absence to accompany Surgeon-General William C. Gorgas and his party as sanitary engineer on a tour of South America to study methods of eradicating fever. Mr. Wrightson has been connected with the Public Health Service for more than a year and a half. He was graduated from the University of Maryland in 1906, after which he spent a few months with the Wildell (W. Va.) Lumber Company on railroad work. From 1907 to 1909 he was chief engineer for the Capuzaya & La Palmilla Mining Company, in Mexico. In 1910 he was associated with General Gorgas as sanitary engineer on the Panama Canal. After two and a half years on the canal he was made engineer for the Texas Company, at Houston, Tex., and late in 1913 became chief engineer for the Pasadena Petroleum Company, at Shreveport, La. From May to December, 1914, Mr. Wrightson was sanitary engineer for the expeditionary forces of the United States Army which occupied Vera Cruz, Mexico.

F. H. Nicholson has been appointed by the New York, New Haven & Hartford Railroad to give his whole time to the subject of automatic train control. His title will be assistant engineer. The New Haven management states that it is the intention to conduct further experiments and tests on its own lines, to make thorough investigation of trial installations on other roads and to continue the examination of train-control devices brought to its attention by inventors and others.

Charles M. Levey has been made president of the recently reorganized Western Pacific Railway. He has been vice-president and general manager since 1909.

Major John C. Oakes, Corps of Engineers, U. S. A., now stationed at Louisville, will be transferred to Philadelphia July 1, where he will have charge of the work of improving the Delaware River and maintaining coast defenses at the mouth of that river. Major Oakes has been connected with the Corps of Engineers since 1897.

Col. George A. Zinn, Corps of Engineers, U. S. A., now stationed at Philadelphia, will, July 1, take charge of the second regiment of engineers, the organization of which was made possible by a recent act of Congress.

Major Robert R. Ralston, Corps of Engineers, U. S. A., in charge of improvement of the Big Sandy River, with headquarters at Cincinnati, will succeed Major Oakes at Louisville July 1.

W. C. Raleigh, city engineer of Tacoma, Wash., for the past seven years, has purchased an interest in the real estate, insurance and loan business of Havelock C. Boyle & Company, of that city, and been made secretary-treasurer. He was appointed assistant city engineer for Tacoma under Frank L. Davis, whom he succeeded as engineer.

Samuel Murray, acting chief engineer for the Oregon-Washington Railroad & Navigation Company, of Portland, Ore., has been appointed permanently to that position.

The Black Masonry & Construction Company, of St. Louis, has opened offices in the Alaska Building, Seattle.

Obituary Notes

Leslie S. Robertson, secretary of the Engineering Standards Committee of Great Britain, was among those who perished June 6 with Earl Kitchener on H. M. S. Hampshire. Since its inception in 1900 Mr. Robertson has been secretary to the standards committee with its one hundred or more dependent and subcommittees, which under this one organization cover the whole field of engineering in Great Britain. He had recently taken a responsible position in the Ministry of Munitions. His exceptional ability, genius for organization and intimate knowledge of men and affairs make his loss to the engineering standards committee almost irreparable. Mr. Robertson was about fifty-four years of age.

Simpson Fleming, consulting waterworks engineer, for thirty years in the employ of the City of Ottawa, Canada, died recently in that city at the age of 89.

Sidney A. Butler, well known in Southern California for his activities in behalf of the good roads movement, and formerly a railroad construction engineer, died recently in Los Angeles. He began railroad engineering about 1870 and assisted in the construction of the Atchison, Topeka and Santa Fé Railway in Colorado and Kansas and in building the branch of that railroad between Las Vegas and Lamy, N. M. He also organized the Los Angeles County Good Roads Association and did much toward the construction of paved highways in Southern California. He was born in 1847 in Milwaukee.

Hiram Tarleton, a member of the New York Central Railroad's surveying squad laying out a new line along the west branch of the Susquehanna River in Pennsylvania, was drowned June 4 in Bald Eagle Creek.